The Glass Industry

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Proceedings of the Glass Division

American Ceramic Society

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ABOUT one thousand members attended the meeting of the seven divisions of the American Ceramic Society, some seventy-five of whom registered as being interested primarily in glass. A list of them appears elsewhere in this issue of our Journal.

Discussions took place and papers were read in several divisions bearing on questions of some interest to glass manufacturers.

In the Art Division a discussion on Glass and Enamel was led by Harold S. Nash, University of Cincinnati. The Ceramic Resources of Oklahoma and their development, by L. F. Sheerar of Oklahoma, A. & M. College, Stillwater, Oklahoma, was a summary of the economic geology of that state relative to clays and shales suitable for clay products, cements and other resources such as glass sand.

Plant trips attended by a number of members were made to the Dominion Glass Company, Ltd., Hamilton, Ontario; General Motors, Ltd.; Feldspar Glass Ltd., and W. E. Phillips Glass Company, Ltd. (unshatterable glass), all of Oshawa, Ontario.

EDWARD ORTON, JR.
New President of American Ceramic Society

Several interesting and important subjects came up for informal discussion by members both in and outside of the regular Glass Division Meeting and at the two enjoyable luncheons served on Tuesday and Wednesday for the glass group. These affairs were planned as a means of encouraging sociability and bringing the members into closer companionship than is possible at the more formal gatherings where reading of papers and the discussions occupy all the available time. Judging from the favorable comments heard on all sides after these luncheons they may become a permanent, enjoyed feature of the annual meetings.

Among the matters talked over at various times was the insistent need of the Glass Division, if it is to forge ahead, obtain full recognition from the glass manufacturers and make itself a vital and effective force in the advancement of the whole industry, for the appointment of a permanent Division Manager to handle its affairs more effectively than is possible under present conditions and carry them on continuously year after year, something which cannot be done properly under a system of annually changing management.

Various solutions for this problem were offered, the practicability of which are being investigated by members known to have the best interests of the Division at heart.

Keen interest has been shown in the proposal of General Orton, just elected the new President of the American Ceramic Society, to bring about a change in the present system of classifying its members. His views on this subject, submitted to the nominating committees before his acceptance of the nomination for the presidential office, were printed in the January issue.

The success of a small experimental "out-of-doors" gathering of glass technologists held late last summer on the shore of Chesapeake Bay evidently prompted a suggestion made at Toronto by F. C. Flint, who was the host on that occasion, that the experiment be repeated this year. A substantial number of the members present when the subject was brought up signified their pleasure in anticipating such a meeting but no definite action was taken in the matter. It will be taken up later in the year.

Glass Division Papers

Reviewed by
Frank W. Preston, Consulting Engineer

The sectional proceedings proper occupied Tuesday and Wednesday of the week. Some twenty-one papers were listed in the Glass Division for reading and nineteen of them were actually presented. Below we give a brief resumé of these papers and of the discussions that followed:

No. 1. Electrical Glass Melting

By Professor James T. Burt-Gerrans, University of Toronto, Toronto, Canada.

In 1922, the Feldspar Glass Company put in a plant at Oshawa, Ontario, to determine the practicability of melting by electricity a glass whose main component was feldspar, thus obtaining a highly aluminous glass which it was believed would be very suitable for glassware that had to resist thermal changes. With power at one-third of a cent per KVA-hrs. and oil at eight cents per gallon, the fuel cost of bottles comes out at about $1.65 for the oil and $1.30 for the electricity, thus showing a substantial saving if electrical energy can be used. The original furnace was a combination of arc and resistance and proved unsatisfactory. For the last year or so, Professor Burt-Gerrans has been re designing the furnaces and experimenting with them and a point has now been reached where feldspar glass is being melted very satisfactorily with a combination of 60 per cent electrical energy and 40 per cent of oil. The electrical part of the furnace now works purely on resistance principles, and wholly electrical melting would be employed if the transformers available had not been provided with fixed secondaries. Colored ware is being made and both rod and tube and bottles have been satisfactorily produced. The furnace measures about 20 feet by five feet and takes a depth of one and one-half feet of metal. A Rankin feeder operates at about 2100 F. and for this style of glass the machine must be run faster than for ordinary lime-soda glasses. The coefficient of expansion of feldspar glass as determined by Professor Burt-Gerrans is about 8.3×10^{-6} but an examination of another sample was reported by Corning to have an expansion of 16×10^{-6}. This matter is therefore being re-examined and will be reported on again later. Tests of thermal endurance were made by transferring bottles from boiling water to ice cold water. About 1 in 36 broke under the shock, whereas four out of five typical lime-soda bottles broke with the same treatment. The bottles are good for filling at 110 pounds per square inch and for capping at 700 pounds. The efficiency of the furnace is about 65 per cent, but this does not include transformer and similar losses. In the discussion it was suggested that the exceptional behavior of the glass under thermal shock might be due to unusual excellence of the annealing which is carried out in an electric lehr. Professor Burt-Gerrans exhibited a number of samples of the glass and of the wares produced.

No. 2. Colored Glass for Technical and Decorative Purposes

By H. P. Gage, Corning Glass Works

The main theme of Dr. Gage's paper was the very different requirements of colored glasses for strictly technical use and those for artistic purposes. For example, the specification of the railroads calls for glasses of solid color; flashed glasses were not permitted as sand blasting on desert sections of the line might eat off the flashing and change the color of the glass entirely. The glass must be free from veins, streaks and bubbles. It is made in seven colors, including red, green, purple, yellow, blue and lunar white. The last is a somewhat bluish white when seen by daylight but appears a normal white when transmitting the light of a kerosene flame. The thickness must lie between .21 and .29 inches. The photometric requirements are specified in considerable detail and are often stringent. For example: a red glass must not pass any light from a sodium flame. This requires the edge of the absorption band to cut in very sharply. Green must be Admiralty Green, which is slightly blue by daylight but appears a normal green when transmitting the light of a Madza lamp. It must pass the blue and green of the spectrum and cut out most of the orange and red. The purple glass must pass most of the blue and a band in the extreme red. Globes must be of a glass having low expansion, high heat resistance and free from opalescence; it must stand boiling for two hours in distilled water without harm. One of the tests consists in tipping the globe at an angle of 45° and heating one side with a smoky flame and thereafter quenching in ice water. As the glasses must be of solid color, the thickness affects the hue a good deal in those glasses in which the edge of the absorption band is not sharp, but makes very little impression on the red glass where the cut off is very sudden. Transmission curves obtained directly by the Wedge spectrograph were projected on the screen, some of them very beautifully colored.

When tableware and decorative glasses came under consideration, it was found that those very qualities which were regarded as technical defects could be used as sources of artistic merit. A number of samples of the work of Mr. Carder of the Steuben Works were exhibited by Dr. Gage and attention called to the pleasing effect that could be produced by varying degrees of opalescence, by crackling and crazing, by streakiness of the glass and by applying flashings in one or more layers and then cutting through with the wheel.

No. 3. Electrical Methods for Determining Moisture

By E. F. Burton, University of Toronto

Professor Burton's paper took the form of an experimental demonstration rather than a paper proper. In connection with Arnold Pitt, he had discovered a peculiar property of a high frequency oscillating circuit. This circuit was of a simple type employing a thermionic valve or radio tube in circuit with the usual inductances, etc. When a rod of some material was placed within the core space of the coils, after the circuit had been adjusted to a suitable sensitivity, a marked change in the character of the plate circuit took place. The reason for this was by no means clear, but experience showed that the change could be used to measure with a high degree of accuracy the presence of, for example, small amounts of moisture. By means of an epidiascope Professor Burton

projected on the screen an image of a milliammeter in the plate circuit of an experimental apparatus set up on the lecture table. His assistant then introduced, into the field of the coils, tubes containing wheat with different amounts of moisture. It was found that a vast difference in the milliammeter reading was produced for the different amounts of moisture. A dry glass tube produced a moderate deflection of the pointer on the ammeter scale, but the merest trace of moisture along one side of the tube produced a very much greater one; this deflection rapidly decreasing as the moisture evaporated. A test tube containing dry sand was then examined and the addition of the most trifling amount of moisture to the sand more than doubled the deflection of the pointer. It was found that for such materials as silica sand the maximum amount of moisture that could be worked with was about one per cent; for larger amounts, good results could be obtained by diluting the moist sand with ten or one hundred pounds its own weight of perfectly dry sand. Samples of Bakelite having resistance of the order of 10^4 ohms/cm^3 and of 10^7 ohms/cm^3 gave quite different deflections and samples of intermediate resistance gave intermediate deflections. It was not known, however, whether the phenomenon was due to the resistance of the specimen or to its dielectric constant or to some other property as yet undiscovered.

No. 4. The Use of the Polariscope in the Glass Industry

By Frank W. Preston, Butler, Pa.

The author described this paper as an attempt to bring together and to express in simple language the fundamental principles underlying the use of the polariscope and the interpretation of its findings so far as they concerned the glass man. At the present time in order to acquire an adequate working knowledge of the subject it was necessary for a student to read at length in treatises on physical optics, on mineralogy, and on elasticity. It was hoped to simplify his work by compiling the present paper. As this paper was necessarily long and did not lend itself to abstracting he asked the section to take the paper as read.

No. 5. Corrosion of Tank Blocks by Opal Glass

By C. J. Uhrmann and S. M. Slater, Inland Glass Works

In the absence of the authors this paper was presented by Dr. Scholes.

It appears from the experience of the authors that there is a pronounced tendency in the melting of opal glasses in day tanks for a fluid layer, quite unlike the rest of the glass, to form on the bottom of the tank. This layer contains much of the opacifying material and is highly corrosive toward the tank blocks. It was found in experimental melts in pots that the separation of the constituents did not take place, if the pots were preheated to melting temperature and the fusion affected with the utmost rapidity. They therefore found that by changing the filling schedule so as to get the tank really hot before filling on the first part of the batch, and then being modest in the amount of batch filled in at one time, they were able to get away from most of their difficulties. So far as the corrosion of the tank blocks caused trouble by setting stones free in the melt, the difficulty could be avoided by the use of Corhart blocks, which, being of fused mullite, were denser than the glass and therefore did not tend to float up into the metal.

In the discussion, Mr. Green of the Kimble Glass Company stated that he had had recourse to tapping the bottom and drawing off through a small hole the very fluid constituents, as he found that the more viscous glass proper would not follow through so small an opening. Dr. Horovitz stated that in Germany recourse had been had to the time-honored custom of blocking the melt with green wood and so, by creating vigorous stirring, getting the whole homogeneous. Donald Ross stated that eating away of the bottoms of tanks was universal with opal glasses. Some folks tried to create circulation in the tanks by holding back the fires at the filling end and then hitting the floating mixture hard as it approached the bridge wall.

Some discussion arose as to the possibility of effecting improvements by changing the oxidizing or reducing character of the flame, but it appeared that reducing flames cut down the opacity. Dr. Scholes suggested that the whole trouble probably arose from the fact that the opacifying materials melted very readily and very quietly without the evolution of gases. He thought it likely that if an ordinary soda-lime glass were made from a fusion of silica, calcium oxide and caustic soda, the similar ready melting of the flux would cause just as much difficulty as was now experienced with the opal glasses.

No. 6. Discussion: Opacifiers for Glass

By A. Silverman, University of Pittsburgh

Professor Silverman reviewed very briefly some of the opacifying agents that had been or now were in use. He made a special mention of sodium silicofluoride which was now commonly employed. It appeared that this material tended to form, somewhat suddenly, vast quantities of silicon tetrafluoride which immediately went up the flue. This material attacks pots more than calcium fluoride (fluorspar) does. On analysis it was generally found that the fluorine content of the glass ran parallel with the calcium content, suggesting that most of the fluorine was held in combination with the calcium.

When using feldspar to produce opalescence the potash feldspar (orthoclase) were more useful than the soda ones. In the old days alumina had been used as an opacifying agent but it now appeared to Dr. Silverman that most of the opacifying produced by the alumina might very well be credited to about 12 per cent of zirconium oxide which was present in the alumina as an impurity. This fact had come to light in recent re-analyses at Pittsburgh.

For some reason lepidolite seemed to work better in tanks than in pots. Some ingredients, for example bone ash, struck white on reheating. In lime and lead glasses whiteness was helped by oxidizing conditions either in the batch itself or in the working conditions, but in the modern zinc alumina boric acid glasses opalescence was produced whether the conditions were oxidizing, reducing or neutral. In such glasses, sodium chloride and sodium sulphate go into solution in amounts up to 2½ per cent of the sand content and the salts ionize. Beyond 2½ per cent a salt water layer is produced. Sodium chloride converts opal into

alabaster. This material was present as an impurity in the old Leblanc soda and when the modern soda was introduced the glasses moved from the alabaster to the opal type for reasons not then understood and much experimentation was needed before the old style of glasses could be properly reproduced.

Dr. Littleton stated that opal glasses were probably less complicated from the point of view of the physicist than from that of the chemist. He recalled some interesting experiments on changes in the viscosity of the glass that came about as the opacifying materials crystallized out.

Dr. Shively controverted the supposed extreme corrosiveness of lepidolite. It seems that lithia is a very fine flux and possibly the main cause of the corrosion. If substituted pound for pound for alumina it will naturally produce more corrosion. Caesium and rubidium salts may be corrosive, as Dr. Silverman suggested, but very little of these salts is present in the modern Mexican lepidolite. How much was present in the original Californian material is not known. Mr. Finn suggested that the additional corrosion with certain oxides was possibly due more to their unusual fluidity than to any especial chemical affinity for the refractory.

Mr. McBerty of the Pennsylvania Salt Manufacturing Company described experiments to determine the effect of various sizes of cryolite on the opacifying properties. He found that the coarser the material the slower the fluxing and opacifying, and the higher the temperature the greater the difference between the properties of the fine and coarse material. Material finer than 300 mesh was particularly difficult to work with.

Attention was also called in the discussion to the fact that some opals turn green in a reducing atmosphere. Professor Silverman then went into a discussion of the effect of oxidizing agents on colloids carrying a negative charge which it appears is the essential character of an opal glass. Under oxidizing conditions the dispersed colloid is agglomerated sufficiently to produce opalescence.

No. 7. Discussion: Close Control of Color and Translucency in Lenses

By A. J. Johnson, Western Electric Company

Mr. Johnson outlined briefly some of the difficulties encountered in making colored glasses for switchboard lenses. He grouped these under two main headings—difficulty in controlling the furnace and working conditions and difficulty in controlling the stability of coloring agents and opacifiers. Most of the glasses contained from 25 to 40 per cent of red lead. They were of several colors of which the blue and green presented little difficulty whereas the red glass was quite awkward and the amber particularly troublesome. In this glass iron, manganese and uranium were used.

Dr. Littleton suggested that the color control might be easier if the color were struck by a reheating process. Dr. Shively recommended the use of opaque enamels sprayed on and burnt in by a second lehr treatment.

No. 8. Production of Glassmakers' Feldspar

By Rudolph Glatly, Feldspar Milling Company

Neither the author nor his paper could be located, and the Division was therefore very reluctantly compelled to forego the pleasure of hearing this paper.

No. 9. Beryllium Glass II; Potassium Beryllium Silicate

By A. Silverman and Chi Fang Lai, University of Pittsburgh

This paper was to have been presented by Dr. Lai but owing to some misunderstanding at the Canadian border he was unable to be present and in his absence the essence of the matter was presented by Professor Silverman.

In extension of the previous work on the soda beryllium glasses, a series of 160 melts of 250 grams each of various potash beryllium glasses had been examined for various physical properties. A peculiar feature of this series of tests was the frequent appearance of an amethyst color, whose source could not be traced. A triaxial diagram was projected on the screen showing the composition of the glasses studied and indicating the areas in which good, clear, transparent melts, free from unfused material and from devitrification products, were obtained. It appeared that a deep indentation into the area of good glass was made by a tongue or zone in which the glass devitrified somewhat readily. Densities varied from 2.455 to 2.482 and the refractive index from 1.514 to 1.526. It was found possible to use less silica and more beryllium oxide than was practicable in the soda series.

Dr. Insley reported that he had examined some of the crystalline material formed but much of it was barely resolvable under the microscope even with an N. A. of .95. Crystals of the hexagonal system with a low order of symmetry were taken to be beryllium oxide with an index of 1.72. Skeleton crystals with an index of 1.53, of unknown composition, nearly isotropic, and not cristobalite, although they look like it, were found, and other material occurring in frondlike growths, with a moderate double refraction.

Mr. Finn called attention to the fact that the rate of cooling of the glasses had been rather slow and might possibly have caused devitrification even in soda-lime glasses.

The discussion also called attention to the fact that so far as any member of the Division knew, we had here recorded for the first time a series of strictly comparable glasses in which the mechanical density and the optical density moved in opposite directions throughout the series, a most unusual circumstance.

Dr. Littleton remarked that as the end points of the series were not those of crystalline compounds but of problematical silicates in an unknown state of amorphous aggregation, there was very little theoretical guidance as to what one might expect of the trend of physical properties as one progressed along the series.

Mr. Gregorius mentioned that the solubility of certain glasses in which both calcium and magnesium oxides were present attained a maximum value when the ratio of the two approached that of diopside.

No. 10. The Influence of Chemical Composition on Refractive Index Softening Point and Density of Soda-Lime Glasses

By J. W. Gill and W. C. Rueckel, Ohio State University

This paper was presented by Mr. Rueckel and illustrated

by a number of diagrams covering some nineteen soda-lime glasses within the commercial field.

The results of the research had been used by Dr. Scholes in his investigation of the possibly additive properties of certain complex silicates supposed to be present in glass as contrasted with the unsatisfactorily additive properties of the simple oxides. The research was particularly useful from the point of view of technical practice since a commercial dolomitic limestone was used in place of the pure calcium oxide commonly used for research purposes. However, the results of the research were somewhat obscured by a rather large proportion of alumina that frequently entered the melt.

Mr. Gregorius stated that the first one per cent of alumina does not much change the softening point (which was the most valuable property investigated by the authors) but that each additional one per cent thereafter seemed to raise the softening point some ten degrees Fahrenheit. This was true, at least, of the second and third one per cent.

No. 11. The Effects of Additions of CaO and MgO Upon Some Physical Properties of a Glass

By C. W. Parmelee and D. T. H. Shaw, University of Illinois

This paper was presented by Professor Parmelee. The parent glass consisted of SiO_2, 58 per cent, PbO, 22 per cent and Na_2O, 20 per cent, a composition that had been chosen on account of its utility in enamels though somewhat unusual in glasses proper. The glasses were electrically annealed and considerable divergence was found in the expansion coefficient as calculated and as found experimentally. Refractoriness was increased by both magnesia and calcium oxide as these replaced the soda, the change being more pronounced in the case of magnesium oxide. The elastic modulus also went up, again more in the case of the magnesium substitution than in the calcium. On the other hand, the refractive index was increased more by the calcium oxide. The solubilities in hydrochloric acid and caustic soda were determined on massive cubes rather than on the powdered glass which is the usual material.

Mr. Finn pointed out that unless the cubes were thoroughly polished, or the grinding very carefully standardized it might be difficult to obtain strictly valid results.

No. 12. The Effects of Additions of Zinc Oxide and Cadmium Oxide on Simple Glasses

By C. W. Parmelee and R. G. Ehman, University of Illinois

This paper also was presented by Professor Parmelee. The parent glass was the same as in the previous research, and zinc and cadmium oxide were substituted in 5 per cent increments up to a maximum of 20 per cent as a substitute for equivalent parts of soda. Both materials lowered the viscosity and increased the refractoriness. The effects of the two oxides were very similar, especially at the lower temperatures. The refractive index, for example, was increased by both about equally. The softening point was raised more by the zinc oxide than by the cadmium. The expansion was approximately linear up to the annealing temperature. Many diagrams were projected upon the screen to illustrate the findings of the research. In reply to a question by Professor Silverman, Professor Parmelee said that no appreciable effect on the color was produced by the cadmium oxide.

A considerable discussion of the two foregoing papers followed in which attention was called to the fact that although calcium and magnesium oxide seemed to act in the same direction when present separately, they did not seem to act concordantly, or in the same way, when both were present together, even in small amounts, according to the findings of Prof. Parmelee. The question was raised as to what effect, if any, there might have been on the physical properties of these glasses, due to the fact that they were melted under reduced pressure.

Mr. Gregorius confirmed the findings of the papers to the extent that he had found that calcium and magnesium oxides, when present in a silicate mix did, in fact, behave more as if they were forming a eutectic than as if they were acting independently.

No. 13. Some Results Obtained Through the Use of Borax in the Manufacture of Tank Glasses

By D. D. Schurtz, The Sharp-Schurtz Company

It was a frequent practice with the older types of glasses to add a few pounds of boric oxide to a batch but this commonly did not produce more than about two tenths of 1 per cent of this ingredient in the final glass. In some of the more modern borosilicate in the boric oxide content runs between 5 and 10 per cent. With the recent decrease in the cost of borax it became desirable to investigate the properties of glasses containing more than .2 and less than 5 per cent of boric acid. This work was undertaken by Dr. Schurtz at the request of the American Potash & Chemical Company on the plant of the Hocking Glass Company at Lancaster, Ohio. The tests were made on a full-sized tank. The temperature ran between 2625 F. and 2675 and the batch contained some feldspar. Borax was added, first at the rate of 15 pounds per ton of sand, gradually raised to 60 pounds, and later to 100 pounds. The lustre of the ware improved very noticeably up to 60 pounds and still further, though not so conspicuously, beyond this point. When the nature of the glass came to be understood, it was found practicable to over-pull the furnace to a remarkable extent, sometimes as much as 80 per cent, and now, in a number of factories, over-pulls of from 25 to 50 per cent are common. The improvement in this particular matter may be due to the fluxing power of the borax, or it may be due to an improvement in the plaining properties of the borosilicates. The original glass contained 8 per cent of calcium oxide and one and one-half per cent of alumina. It was found that when one and one-half per cent of boric oxide had been added, the glass became very suitable for the feeders and checks and breakage decreased notably. With increasing pull, solution of the tank walls per ton of glass decreased, and consequently less decolorizer was needed. There was also an improvement in durability and in reduction of bloom. The durability as determined by the autoclave test of massive specimens and of powder indicated that the powder was much less improved than the ware as a whole, so that for some reason the boric acid must improve the surface of the ware more than it improves the body. This is borne out by the lessened tendency to check. The borax seems particularly

suited for the production of emerald green glasses and cords are also reduced by its use. However, the machine conditions are important and the amount of improvement affected varies considerably with these conditions. The utility of the borax is not confined to feldspar glasses and improvements are noted both with dolomitic and straight lime glasses. The soda should be cut to the extent of one-half of the borax added. This reduces the total sodium content of the glass and possibly accounts for some of the improvements. After 30 pounds of borax has been added, greater fluidity is noted and the fires have to be adjusted to avoid seeds. Glasses of the new type are now being used for bottles, both white and colored, and for pressed and blown ware, and there is some prospect of their coming into use among the sheet and plate glass manufacturers who are generally more conservative.

A considerable discussion followed on the volatilisation of boric acid, the cause of such loss, and the effect of the material on the checkerwork. The question was also raised as to the behavior of boric acid when present in glasses containing lead and iron in any appreciable amount. On this subject Dr. Ferguson gave some useful information. It appears to be quite difficult at present to adjust borax in glasses of this type.

No. 14. The Electrochemical Behavior of Glass

By John Bright Ferguson, University of Toronto

This research arose out of the observation of Rebbeck that gas formed, under certain conditions, at the mercury glass interface of a thermo-regulator. This gas formed only when the current flowed in one direction and disappeared again when the current was reversed. The gas is mainly hydrogen and under some conditions voltages as low as .8 volt arcoss one mm. of glass will produce the effect. At the anode the gas is removed by oxidation of the mercury. It has been established that conduction of electricity through glass is electrolytic in character even at room temperature. The apparent resistance of the glass varies with the applied voltage. A study of the phenomenon suggests that inside the glass Ohm's law is strictly valid and that the rest of the voltage is accounted for by a polarization potential at the surface of the glass. Complicated changes of resistance take place when the current is reversed, apparently due to spasmodic puncturing of the surface film and to the growth of the punctured zones. Photomicrographs of the appearance of the surface at various stages were thrown upon the screen. It seems that the critical surface lies about 1,000 of a mm. below the surface proper. Dendritic growths of silver can be formed in the glass by driving in silver ions from an aqueous solution, putting the cleaned tube back in contact with mercury on both sides and reversing the direction of flow of the current. Some excellent photomicrographs were projected on the screen and attention was called to the fact that the silver was inaccessible to nitric acid.

No. 15. Progress Report on Bureau of Standards' Investigation of the Effect of Dissolved Gases in Glass

By R. C. Darnell, Bureau of Standards

In Dr. Darnell's absence, this paper was presented by Mr. Finn. This paper was a very preliminary report showing the nature of the set-up and the difficulties that had been met and overcome in the working of the apparatus. The Ajax high frequency furnace has now been modified; works satisfactorily up to 1,500 degrees centigrade and can be maintained steady for long periods to within five degrees C. Water is removed by P_2O_5, the CO_2 is next removed, the oxygen burned with hydrogen, and the rest is reckoned as nitrogen.

Dissolved gases from similar melts identically processed vary considerably in amount and under these conditions no correlation has yet been established between gas content and *time* of fining. However, it has been established that the gas content is less as the *temperature* is increased. Water is found to the extent of from 10 to 20 per cent of the total volume of gases, although all the ingredients of the batch have been dried as thoroughly as possible. It seems to be exceedingly difficult to get the sand completely dry. The temperature of fining has little influence on the amount of water discovered but has a profound influence on the amount of CO_2, which is the bulk of the gas. Oxygen generally runs about 5 per cent. Dr. Darnell finds that glasses from which the gases have not been removed are very apt to explode on cooling, if not well annealed, whereas the difficulty does not seem to occur with the gas free glasses.

No. 16. Modified Method for Decomposing Aluminous Silicates for Chemical Analysis

By A. N. Finn and J. F. Klekotka, Bureau of Standards

This paper was presented by Mr. Finn. Reflecting on the fact that portland cement, consisting largely of lime and burnt clay, can be made to set hydraulically to a very hard mass by the addition of water and yet this mass is readily decomposed by small amounts of acid, Mr. Finn was led to consider whether a somewhat similar phenomenon might not be observed in the reaction of glasses, for example, and other refractory materials, towards sodium carbonate. As a result of experimentation at various temperatures and for various lengths of time, it was found that the great excess of sodium carbonate commonly used for fusing refractory silicates is not necessary and in fact, commonly produces less result than a smaller amount of the reagent, scarcely exceeding the weight of the sample itself. The idea is to avoid the formation of a thoroughly glassy mass and to produce instead a sinter or powder by reaction with a minimum quantity of the reagent. It is then found that solution by hydrochloric acid is a very simple matter. A temperature of 875 degrees centigrade is recommended as a good average for ceramic materials generally.

No. 17. Dimensional Changes Caused in a Pyrex Glass by Heat Treatment

By A. Q. Tool, E. L. Peffer and J. B. Saunders, Bureau of Standards

This paper, presented by Dr. Tool, continues the previous work on the subject and investigates by means of a differential thermocouple the rates of heating of samples of pyrex glass as compared with a neutral body. The range of temperature over which anomalies occur is wider in the case of pyrex glass than with the commoner materials. Soaking the glass at various temperatures for a long period modifies profoundly the character of these anomalies. Changes of density also are induced by the heat treatment, a minimum

density occurring when the glass is soaked at 560 centigrade and a maximum at about 720. After heat treating at low temperatures the glass does not reach its original condition, that is the condition in which it is received from the factory, unless it is first given an intermediate heat treatment at a comparatively high temperature. The research was quite laborious, some of the heat treatments lasting as long as 4,000 hours.

No. 18. Crystallization Relations in Soda-Lime-Silica Glasses

By G. W. Morey, Geophysical Laboratory

Dr. Morey was not present and only an abstract of his paper was available. This was presented by Prof. Ferguson. The paper outlines, with more precision, that part of the field of lime-soda glass composition in which the compound $Na_2O.3CaO.6SiO_2$ occurs. For this purpose some sixty glasses have been examined. The compound is now recognized as important in a number of technical glasses.

No. 19. Notes on the Chemical Analysis of Glass

By G. E. F. Lundell, Bureau of Standards

This paper presented briefly by Dr. Lundell in person cannot be usefully abstracted. The stability of powdered glass samples, the determination of boron, the determination of fluorine, the determination of silicon in the presence of fluorine, and some further observations on the use of 8-hydroxyquinoline in chemical analysis were touched on. Attention was called to the fact that powdered glass seemed to take up CO_2 as well as moisture from the air and that ignition at 900 degrees C. would not remove the carbonic acid.

The fact that in determining ferrous iron the material is very readily oxidized to the extent of at least 50 per cent of its weight by the usual methods of grinding was also brought to the notice of the Section. No change is proposed in existing methods of determining boron.

No. 20. Actions of Dust from the Batch on the Checker Brick of Glass Furnace Regenerators

By D. S. Beliankin and M. A. Besborodov, Mineralogical Laboratory, Polytechnic Institute in Leningrad

This paper was presented by Dr. Insley. The paper described the results of microscopic examination of checker bricks that had been attacked by dust from batch filling. The bricks came from pot furnaces of two different types. Crystals of nepheline, carnegieite, and mullite are noted, but the chemical composition does not seem to be wholly accounted for by simple reaction between flue dust and brick. So far as could be ascertained the work confirmed the results of Insley already published.

No. 21. On Expansion-Measurements of Several Glasses by Means of Self-Registering Apparatus

By Willi M. Cohn, Berlin, Germany

At the time of the meeting this paper had not been received and accordingly its discussion had to be held over to some future date.

Some of Those Present

M. G. Babcock (Pittsburgh Plate Glass Co.).
James Bailey (Bailey & Sharp).
H. Clifford Bates (Corning Glass Works).
Milton F. Beecher (The Norton Co.).
M. L. Begeman (Mississippi Glass Co.).
H. R. Black (Libbey-Owens Glass Co.).
F. O. Brown (Fostoria Glass Co.).
W. L. Brownlee (Buckeye Clay Pot Co.).
E. J. Brunning (Consumers Glass Co., Ltd.).
James T. Burt-Gerrans (University of Toronto).
E. F. Burton (University of Toronto).
E. W. Campbell (Simplex Engineering Co.).
G. Percy Cole (Dominion Glass Co., Ltd.).
G. W. Cooper (THE GLASS INDUSTRY).
W. F. Curtis (Fostoria Glass Co.).
Ralph Day (Corning Glass Works).
C. M. Dennis (American Potash & Chemical Corporation).
W. F. Dingley (Pacific Coast Borax Co.).
T. C. Earnill (Owens-Illinois Glass Co.).
J. B. Ferguson (University of Toronto).
A. N. Finn (Bureau of Standards).
F. C. Flint (Hazel-Atlas Glass Co.).
J. Earl Frazier (Simplex Engineering Co.).
Gordon S. Fulcher (Corning Glass Works).
H. P. Gage (Corning Glass Works).
Weston H. Gillett (Macbeth-Evans Glass Co.).
Ray S. Godard (H. L. Dixon Co.).
J. F. Greene (Kimble Glass Co.).
J. S. Gregorious (Pittsburgh Plate Glass Co.).
Howard L. Haney (Harshaw Chemical Co.).
E. L. Hettinger (T. A. Willson Co.).
Carl R. L. Hilgenberg (Carr-Lowrey Glass Co.).
H. P. Wood (Corning Glass Works).
J. C. Hostetter (Corning Glass Works).
A. T. Houser (Woods-Lloyd Co.).
J. E. Hutchinson (Pennsylvania Salt Mfg. Co.).
Herbert Insley (Bureau of Standards).
C. F. Israel (Akro Agate Co.).
A. G. Johnson (Western Electric Co.).
V. V. Kelsey (Consolidated Feldspar Corporation).
Arthur W. Kimes (*National Glass Budget*).
M. M. Langley (Johns-Manville Corporation).
Theodore Lenchner (Roessler & Hasslacher Chemical Co.).
J. T. Littleton (Corning Glass Works).
Garland Lufkin (Owens-Illinois Glass Co.).
Karl Lark-Horovitz (Purdue University).
G. E. F. Lundell (Bureau of Standards).
F. L. Macnamara (Ball Bros. Co.).
R. K. McBerty (Pennsylvania Salt Manufacturing Co.).
George V. McCauley (Corning Glass Works).
Clarence B. McComas (Carr-Lowrey Glass Co.).
F. R. Meyer (Laclede-Christy Clay Products Co.).
L. R. Milford (Solvay Sales Corporation).
John M. Neff (Bausch & Lomb Optical Co.).
Walter W. Oakley (Corning Glass Works).
A. C. Parker (Libbey-Owens Glass Co.).
Chas. Parker (Mississippi Glass Co.).
C. W. Parmelee (University of Illinois).
L. E. Pinney (Corning Glass Works).
Frank W. Preston (Butler, Pa.).
R. J. Rees (Corning Glass Works).
V. H. Remington (B. F. Drakenfeld & Co.).
Harry A. Richard (Roessler & Hasslacher Chemical Co.).
H. K. Richardson (Westinghouse Lamp Co.).
Evan Rinehart (Johns-Manville Corporation).
Louis C. Roche (Maryland Glass Co.).
W. A. Rudisill (Thatcher Manufacturing Co.).
W. C. Rueckel (Ohio State University).
Donald Ross (Findlay Clay Products Co.).
S. R. Scholes (Fostoria Glass Co.).
D. D. Schurtz (Sharp-Schurtz Co.).
M. R. Scott (Bausch & Lomb Optical Co.).
R. R. Shively (B. F. Drakenfeld & Co.).
J. E. Shull (Vitro Manufacturing Co.).
J. L. Sills (Dominion Glass Co., Ltd.).
Alexander Silverman (University of Pittsburgh).
Charles D. Spencer (General Electric Co.).
V. C. Swicker (Hartford-Empire Co.).
W. C. Taylor (Corning Glass Works).
E. Ward Tillotson (Mellon Institute).
Arthur Q. Tool (Bureau of Standards).
M. S. Van Dusen (Bureau of Standards).
Jack H. Waggoner (Mellon Institute).
H. L. Watson (General Electric Co.).

TOP VIEWS:—BROOKVILLE LOCOMOTIVE HAULING 7½ TONS FROM NO. 5 MINE TO PLANT NO. 4 MINE BIN AND DERRICK AT LEFT. FIG. 1. EARLY OPERATIONS ON BEAVER CREEK. FIG. 2 THE DEER PARK MINES IN 1922.

Feldspar Development

Early Struggles Involved in

By B. C. BURGESS

A FEW years ago the production of feldspar was in the hands of many small operators. There was over-development of grinding capacity and the equipment was old and inefficient. There was lack of knowledge of chemical properties of the product by producers and consumers. Few producers had any conception of the general situation in the industry.

The result was that costs were high, profits low and the quality of the product uncertain. Small operators could not afford expensive supervision such as was necessary for the efficient mining of a product hidden by nature in the most puzzling formations of any of the non-metallic minerals.

For the same reason supervision of grinding processes was not competent for the most economical production of the finished product.

With the business divided among many small operators, chemical control, because of its cost, was out of the question even among those who had sufficient knowledge of the industry to foresee and appreciate its possibilities.

The details of these former ills of the industry could be described at length but as they are now generally recognized and are being substantially eliminated, it will be more profitable to consider the remedies which have been applied and the improved situation that has resulted.

What has come about is that eighty per cent of the feldspar business has been consolidated into the hands of the four largest producers.

Over-development, although still a factor, has been reduced from 400 per cent to about 200 per cent, largely as the result of increased consumption.

New equipment has largely replaced that in use in 1919.

Producers and consumers are bringing their plants under chemical control.

The Feldspar Grinders' Institute, an association of feld-

in North Carolina

Modernizing the Industry

—Tennessee Mineral Products Co.

spar producers has been formed primarily for the purpose of studying the industry and is already taking steps to place it on a still sounder basis.

An improved situation has resulted, due partly, no doubt to the same general conditions which have more or less affected all industries in recent years.

The resulting modernization of production methods and strict control of the finished product through chemical analysis have combined to raise the feldspar industry to the highest level of efficiency ever reached and still further progress will undoubtedly be made.

One of the notable factors in this revolutionary development during the past eight years has been the successful establishment of a large modern grinding plant in a locality formerly in bad repute as a source of dependable feldspar—North Carolina.

This plant was started by the Tennessee Mineral Products Company's organization with no previous experience in the industry. Principally by the application of control methods to production the company has succeeded in producing a substantial percentage of the annual tonnage consumed in this country.

In view of the importance of feldspar to the glass man and the advantage to him of knowing how his raw materials are produced, a brief history of the development of the company and its methods of production will be of interest.

The History of the Project

The company started production of crude spar in the summer of 1921, selling the small output in the local market. At the same time experiments were conducted at manufacturers' plants for the purpose of determining the most efficient milling processes.

The mines and plants of other producers were visited

FIG. 3. DOGWOOD FLATS MINE. FIG. 4. THE MILLSITE IN MARCH, 1926. FIG. 5. THE PLANT IN OCTOBER, 1926. FIG. 6 LABORATORY AND OFFICE.

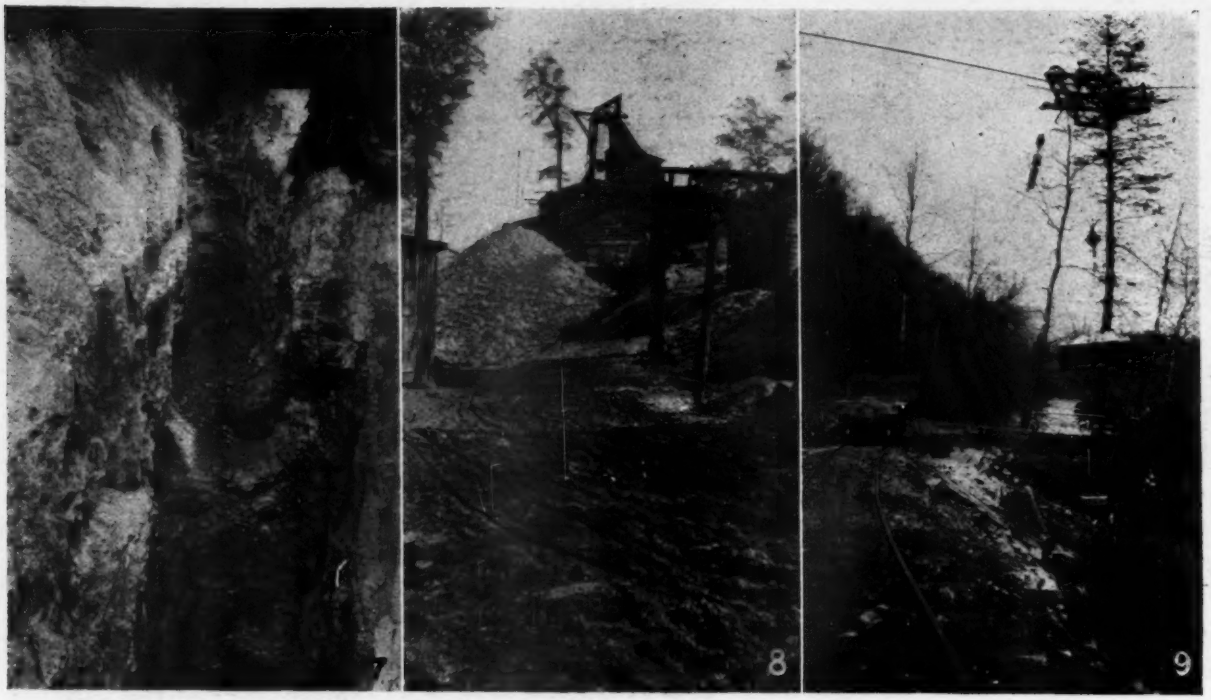

FIG. 7. WISEMAN NO. 1 MINE. FIG. 8. JOPLIN TYPE HEAD TRAIN AT DEERPARK NO. 5 MINE. FIG. 9. FLORY CABLE WAY TRANSFERRING SPAR FROM MINE RAILROAD TO PLANT

and all available literature studied. One of the most helpful influences at the time was the publication in 1922 by the Bureau of Mines of Raymond B. Ladoo's "Report of Investigation of Conditions in the Feldspar Industry." Mr. Ladoo recommended many of the improvements which the Tennessee Mineral Products Company has taken advantage of. He also accurately stated the need for reorganization of the industry which has only recently been attempted.

The early mining efforts and research of the company disclosed to them that the pegmatite dykes from which feldspar can be commercially recovered are generally conformable with the stratification of the schists and gneisses enclosing them, and that the occurrence of feldspar with respect to these dykes is in one of three ways:

1. Occupying the larger part of the pegmatite and conforming with it in strike and dip.

2. As a cross dyke or fissure filling occurring at or near right angles with the strike and dip of the pegmatite enclosing it.

3. As hit and miss occurrences in varying sizes scattered irregularly through the parent dyke of pegmatite.

Characteristic features of the *first* occurrence are:

High proportion of segregation of the three principal minerals, feldspar, quartz and mica throughout the vein.

High ratio of soda to potash content.

Ratio of width to length, one to five or more.

Fair degree of regularity in size and shape of deposits.

Characteristic features of the *second* type of occurrence are a marked segregation of the principal minerals in the center but a lesser segregation at the sides of the dyke.

Great irregularity as to the soda-potash ratio in different parts of the dyke.

Ratio of width to depth and length less than for the first type and averaging perhaps one to four.

Not much regularity in size, fairly regular in shape, but inclined to fork or branch as they ascend.

Similar features of the *third* type are:

A lesser segregation of the principal mineral throughout the deposit.

High ratio of potash to soda content.

A tendency to have a greater ratio of width to length, than the other types resulting in more nearly spherical deposits or thick lenses.

Extreme irregularity in size.

Interesting geological deductions may be drawn from these observations, but they are beyond the scope of this paper.

The practical ceramic deductions are that,—

Soda spar is best obtained from Type One.

Close chemical control must be exercised over products of deposits of Type Two.

Type Three deposits are of more uniform chemical composition but most expensive to mine.

Few deposits are distinctly one or the other of these types, portions of the same deposit at times showing characteristics of first one and then another type.

The New England deposits being found to be principally of the third type, it was more easily understood how they could supply a fairly uniform product without chemical control.

The North Carolina deposits being of all three types, with frequent combinations of two or more, it was also understandable why producers in that section were having so much trouble from lack of uniformity.

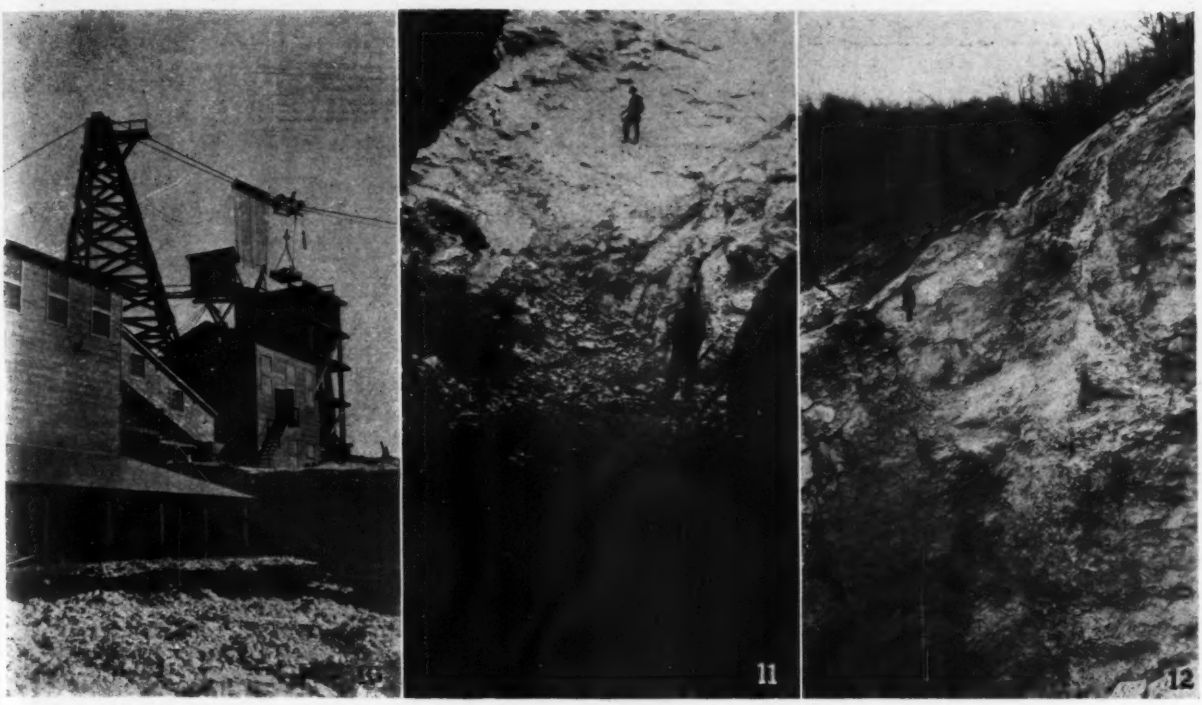

FIG. 10. FLORY CABLEWAY. FIGS. 11 and 12. BUNA WISEMAN MINE.

The company's study of the milling situation indicated that a conical mill in closed circuit with a centrifugal separator was the most efficient fine grinding equipment. A small single unit plant was built at Bristol, Tennessee, in 1923 to gain practical experience in grinding and supplying the trade. A single large feldspar deposit of exceptional purity was obtained as a source of crude spar for this plant.

A laboratory was built at the plant and fully equipped for the complete analysis of feldspar. A contract had previously been entered into with the Roessler & Hasslacher Chemical Co., for sale of the product.

At first there was the usual suspicion throughout the trade against a new brand of feldspar. Finally, however, after concerted efforts by the sales organization, a white ware plant in the East Liverpool district was prevailed upon to give the new spar a trial. The trial was satisfactory, and by similar methods very slowly and gradually a sufficient market was built up to permit continuous operation at mines and plant.

This operation soon disclosed that even the product of a large deposit like the Deer Park mine would show a serious variation in chemical analysis between shipments unless grinding was made from the average of a very large stock pile. Production from this pilot operation also disclosed various process features and methods of general metallurgical use which were adaptable to feldspar grinding.

As information was accumulated, such of the ideas as could be incorporated in the Bristol plant were immediately adopted.

The trade gradually began to appreciate uniform quality and the analytical service, which had been inaugurated shortly after the laboratory was completed.

The Bristol plant was nearing capacity in 1925. Plans were made immediately for a larger plant, incorporating all of the experience of the company to that time, and sufficiently flexible to permit changes and additions.

The new plant at Spruce Pine was started early in 1926 and completed in December of that year. In August 1927 the Bristol plant equipment was moved into the place provided for it in the Spruce Pine plant. Both of these units being sold to capacity, a third unit was added in 1928.

The present plant at Spruce Pine embodies all the ideas developed through the company's research and practical experience during the period of its development. It will be described in sufficient detail to bring out the important features of chemical control and continuous process grinding.

(To be continued)

The Journal of Rheology

The Society of Rheology has been formed to foster the development of the science of rheology by every available means; among others by publishing the Journal of Rheology which is to be issued quarterly.

Rheology is a new word recently adopted. It covers the science of deformation and flow of matter. All matter which flows or is deformed comes within its scope. Glass is included along with other materials such as paints, lacquers, resins, plastics, starch, rubber, metals and alloys, oils, clay, rayon, petroleum, cement, soils, foods, roads, glue, soap, emulsions, printing ink, sugar, molasses, fats and wares. The laws covering plasticity, elasticity and viscosity need to be investigated. All of these problems are based on natural laws and hence can be solved by learning these laws and developing them into a science. The flow of electrons has developed into the science of electricity; similarly the flow of matter will be developed into the science of rheology. A staff of twenty-five under the leadership of Professor Eugene Bingham will supervise the *Journal's* editorial matter. The Chemical Foundation, Inc., will conduct its business management. The office of the new publication is at 654 Madison Avenue, N. Y.

Economics of Producer Gas, Fuel Oil and Natural Gas Compared

(IN 5 PARTS)

by JOHN W. ROMIG, M. E.
Corning Glass Works

Part IV.—Analysis of Natural Gas as Tank Fuel

CALCULATIONS as developed herein are applicable to butane, oil still, blue and water gas providing that proper analytical values and data are substituted for the corresponding items shown below. In the case of natural gas it is impracticable to preheat the gas in checker chambers because hydrocarbons tend to break down and there are dangers of explosions. The method herein is based upon the same size of tank, same checker capacity, same combustion chamber volume and same operating conditions as were involved in the producer gas and fuel oil calculations.

Fuel gas is best admitted to producer gas fired tanks by having a header along each regenerator, each header having valved branches to ports with main control valve for use in reversing. The tank gas and air reversing values are reversed as for producer gas unless it is decided to waste through the air checkers only. As a rule it is advisable to make use of all available checkerwork and waste through both air and gas valves and to take air through both. Data taken for investigating natural gas as a tank fuel includes tank temperature (2,600 F.), air preheat (2,300 F.), tank pull. Thirty per cent excess air is the same value used for fuel oil calculations.

In purchasing natural or other fuel gases, contracts as a rule specify the limits of heat contents and the price is based upon a certain B.T.U. gas per cubic foot at 60°F. and 14.9 pounds absolute pressure. In Kansas natural gas from certain wells has heat values as low as 130 B.T.U. per cubic foot; however the average natural gas has a heat content of about 1,050 B.T.U. per cubic foot. For this calculation it is assumed that natural gas of 1,000 B.T.U. heat content per cubic foot is available on contract at 14.9 pounds pressure absolute and 60° F. temperature.

The probable analysis of this gas by volume is: 70% methane, 20% ethane and 10% nitrogen. There are other hydrocarbons present in natural gas besides the above, however they, as a rule, are present in very small quantities. Propane, butane and even the gasoline group are present in the gas at its starting point; high pressures in pipe lines will condense these constituents and as a rule only traces remain at the burner.

The first step in the study of natural gas combustion in a tank is to determine the combining proportions and then work out the oxygen requirements and waste gas proportions. In the example, 30 per cent excess air is admitted.

Combining proportions—

Methane—

$CH_4 + 2\ O_2 = CO_2 + 2\ H_2O$.

That is, for one volume of CH_4, 2 volumes of oxygen are required and one volume of carbon dioxide is liberated along with 2 volumes of water vapor.

Ethane—

$2\ C_2H_6 + 7\ O_2 = 4CO_2 + 6\ H_2O$ or

$C_2H_6 + 3.5\ O_2 = 2CO_2 + 3\ H_2O$.

One volume of ethane requires 3½ volumes of oxygen and 2 volumes of carbon dioxide are released along with 3 volumes of water vapor.

With the 1,000 B.T.U. gas selected, the oxygen, air and waste gas volumes per cubic foot of natural gas are developed in tabular form below:

Constituent	Vol. constituent per cu. ft. gas	Oxygen required	CO_2 formed	H_2O formed	N_2 accompanying
CH_4	.70	1.40	.70	1.40	5.32
C_2H_6	.20	.70	.40	.60	2.66
N_2	.10	....	....	....	.10
Totals	1.00	2.10	1.10	2.00	8.08
30% excess air		.63	....	....	2.40
Totals	....	2.73	....	....	10.48

From the above one cubic foot of natural gas requires:

Oxygen for Combustion..... 2.10 cu. ft.

Accompanying N_2 plus N_2 in gas..... 8.08 cu. ft.

The waste gas analysis is given below. It is evident that the CO_2 value is low with 30% excess air. However, the ratio of H_2 to C is high and if the excess air is cut too low to maintain high CO_2 then losses in the form of formaldehydes may result. This phenomena is often evidenced by the odor of acetic acid in waste gases if insufficient oxygen is supplied.

DRY WASTE GAS ANALYSIS—NATURAL GAS

Constituent	Volume per cu. ft. gas	Per cent by volume dry waste gas
CO_2	1.10	9.0
O_2	.63	5.2
N_2	10.48	85.8
Total	12.21	100
H_2O	2.00	.....

The waste products per cubic foot of gas summarized are:

CO_2 ..... 1.10 cu. ft.

H_2O ..... 2.00 cu. ft.

Oxygen (from excess air) ..... 0.63 cu. ft.

N_2 from gas and air..... 10.48 cu. ft.

Total ..... 14.21 cu. ft.

Heat entering tank combustion chamber per cubic foot of fuel gas:

The temperature of the fuel gas is taken at 60° F. so there is no sensible heat in the gas itself above 60° F. The volume of air is equal to the volume of O_2 plus the volume of N_2 or 2.73 + 10.48 or 13.21 cu. ft. per cubic foot of gas. The sensible heat of 13.21 cu. ft. of air at 2,300° F. above 60°F. is 13.21 × 46.2 or 620 B.T.U.

Sensible heat in the waste gases (cu. ft. of gas, at 2,600° F. above 60° F. is:

Constituent	Volume	Heat per cu. ft.	Heat per natural gas
CO_2	1.10	90.6	99.4
H_2O	2.00	77.	154.
O_2	.63	54	34.0
N_2	10.48	54.	566.6
Totals	.....	....	854.0

The heat balance per cu. ft. natural gas then becomes—

Sensible heat entering with natural gas.....	0 B.T.U.
Chemical heat in natural gas.....	1,000 B.T.U.
Sensible heat in air supplied natural gas....	620 B.T.U.
Total heat in per cu. ft. fuel gas.....	1,620 B.T.U.
Sensible heat leaving with products of combustion and excess air per cu. ft. fuel gas	854 B.T.U.
Net heat delivered and remaining in combustion chamber per cu. ft. fuel gas.....	766 B.T.U.

For 1,000 cu. ft. fuel gas, the usual unit of purchase, 1,000 × 766 or 766,000 B.T.U. considered as useful heat.

Often fuel gases other than natural gas are available. The table below shows the properties of those common commercial gases as given by Bulletin No. 17 of "Kansas City Testing Laboratory."

Constituent or property	Coal gas	Lignite gas	Water gas	Oil gas
Methane	40.00	15.59	2.00	57.70
Ethylene	4.00	3.25	.....	38.10
Hydrogen	46.00	45.16	45.00	3.40
Carbon-monoxide .	6.00	17.24	45.50	0.50
Carbon dioxide...	0.45	11.51	4.00	0.30
Nitrogen	2.05	5.49	2.00	.....
Oxygen	1.50	1.76	1.50	.....
B.T.U. per cu. ft.	755.	500	350	1,390

The procedure to follow for any fuel gas is similar to that for producer gas as given in Part II and that above. In Part V the three fuels analyzed in Parts II, III and IV will be compared on an economic basis.

Rarer Elements in the Glass Industry

by H. CONRAD MEYER[1]

Many of the so-called rarer elements have been used by glassmakers for several decades. Others have just come into prominence within the last year or so. Many of them are used at the present time only on a small scale due to the high cost. However, where a genuine demand exists for quantities large enough to warrant increased production, it has been found that the price can always be reduced to a point where the glassmaker can use it without abnormally increasing his batch costs.

CERIUM OXIDE is used in limited quantities in optical glass where it is desired to cut out ultraviolet light. It produces a bright yellow glass, and where this color is objectionable for optical purposes a very pure manganese dioxide is added to mask the yellow tinge. It is an expensive oxide and can only be used for special glasses.

DIDYMIUM OXIDE imparts amethystine and orchid shades. It must be of the highest purity and free from cerium and other elements of the same group. This oxide is said to be used in the so-called Alexandrite glass now being produced in Czechoslovakia.

IRON CHROMITE. This is a natural mineral ground to an impalpable powder and air-floated. It is now being used on a large scale as a substitute for the more expensive chrome oxide and sodium chromate. It imparts beautiful emerald green tints and is employed wherever a cheap green glass is demanded. It is generally used in the proportion of 15 to 20 pounds per 1,000 pounds of sand. It is essential that the material be of extreme fineness, as otherwise objectionable black specks are produced in the glass. It carries from 45 to 48 per cent chromium oxide, the balance being principally iron oxide with smaller quantities of aluminum and magnesium oxides and silica.

SELENIUM. This element closely allied to sulphur in its chemical and physical properties, has been used for many years in the production of ruby glass in conjunction with cadmium sulphide. It is rather difficult to handle, due to its volatile character, and considerable experience is required for the production of a satisfactory ruby glass suitable for railway signals and other purposes where a red glass is required. The most important use of selenium is as a decolorizer. Formerly manganese dioxide was used for this purpose but its tendency to produce amethystine tints in the glass on exposure to sunlight caused its abandonment in favor of selenium. Various decolorizing compounds are marketed, all of which contain selenium in some form or other, either the metal or one of its salts, cobalt being sometimes added.

TITANIUM DIOXIDE. This product appears on the market in the form of a pure white powder carrying from 98 to 99 per cent titanium oxide. Its use is comparatively recent and very little of a technical nature has been published. It is principally used in fine table glassware in quantities of about 100 pounds of titanium dioxide per 1,000 pounds of sand. It imparts what is known as a "watered yellow" color. It is not a strong color but gives very pleasing and beautiful effects. Cerium oxide is sometimes mixed with it to strengthen the color and to obtain certain desired effects.

URANIUM OXIDE. This appears on the market as sodium uranate and also as uranyl carbonate. It produces the beautiful fluorescent greenish-yellow glass which has been so popular for the last few years. It is reported that its use has spread to tank glass. This no doubt will result in a much larger consumption of the oxide. The production of this color is almost wholly in the hands of foreign manufacturers.

ZIRCONIUM OXIDE. This appears on the market in the form of the native oxide known as zirkite. It carries from 65 to 75 per cent zirconium oxide. Its use is said to reduce the coefficient of expansion and toughen the glass. This is a very desirable thing, particularly in the case of milk bottle glass where the breakage is very high. The silicate of zirconium, otherwise known as zircon or zirkosil, is also used for the same purpose but in much smaller quantities.

[1] Vice-President, Foote Mineral Co., Philadelphia, Pa.

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ESTABLISED 1920

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Predicts "The Plastic Age"

Reviewing the progress made by the chemical industries during the past year an editorial writer predicts in a prominent chemical trade journal the oncoming in the not distant future of "The Plastic Age." Three factors he considers to have already been instrumental in developing greatly accelerated activity in the plastics industry—first, the increased demand for laminated safety glass, second, the great advances made in resin-molding technique, third, the development of a multitude of better looking and more durable products for household and general uses for which the public has created an enormous demand.

The last two factors of course are of concern to the glass man only when such articles come into competition with glass products but safety glass and the future of the safety glass industry are of vital importance to the glass industry in general. The extent to which laminated glass has already been developed in this and other countries, the tests which this product has undergone in actual service on a large scale over a period of several years and the general public awakening to the danger of serious injury from broken glass, all indicate that the use of safety glass in automobiles and probably in public passenger conveyances of all kinds will become almost universal.

That its introduction has already progressed far is indicated by statements made by another writer as to the quantities of chemicals consumed in cementing together the two sheets of glass used for making one sheet of laminated glass. According to this authority the present annual requirements for pyroxylin sheeting amount to approximately 20,000,000 pounds, representing the consumption of 2,500,000 pounds of nitrate plastic equivalent to nearly one-twelfth of the entire production of that material. The materials required for the production of such compositions include about 15,000,000 pounds of cotton linters, 35,000,000 pounds of nitric and sulphuric acid, 15,000,000 pounds of alcohol, and 7,000,000 of camphor. Large quantities of similar chemicals are also being imported for the same purpose.

Though the consumption of laminated glass is being slowed down temporarily due to the same conditions that have caused some slackness in other industries, when it is considered that at least 20,000,000 closed motor cars are in existence and that only a very small percentage of them have been fully equipped with safety glass, and that probably the remainder will soon be using safety glass at least for windshields, the future of this industry seems to be safe. However, it is not expected that there will be a sudden rush of glass manufacturers into the laminated glass business for without a thorough knowledge of the chemical problems involved, an understanding of the somewhat delicate processes required and the risks in manufacturing operations, failure would be almost certain.

Bulletin on Chemical Engineering Courses

The University of Michigan, Ann Arbor, Mich., has issued a new bulletin on chemical engineering. The opportunities for special study and facilities available at the University are pointed out. Various courses which deal with furnaces and ceramic materials are described. Illustrations of the engineering and chemistry buildings, combustion and ceramics and other laboratories are given.

Feldspar Producers Meet Changing Demands

by E. W. KOENIG[1]

As recently as two years ago many ceramic manufacturers, in placing their orders, specified "a car of spar." That day is passed —each consumer has a particular problem and his needs must accordingly be considered with that in mind. The feldspar producer who hopes for success must be prepared to furnish indefinitely uniform grades of material; he must anticipate the demands likely to be made on him and be prepared to meet them.

The cry of the feldspar consumer is uniformity. How may this be attained? Since no alteration can be made in the natural occurrence of the crude mineral, the obvious answer is in establishing a means of controlling it after it is mined.

No feldspar in its natural occurrence is entirely uniform in commercial quantities. Some more than others, approach this utopian condition in that the impurities are more or less definitely segregated and may be eliminated fairly readily without reducing the pieces of spar to impractical small sizes in concentrating at the mine. Experienced selectors attain a remarkable degree of proficiency in supplying the mills with a partially uniform product, but this at best does not meet the demands of the trade. Spars from the same mine vary in chemical composition due principally to variations in the percentage of free quartz. By removing most of the free quartz, by proper concentrating methods, the feldspar from the same mine tends toward greater uniformity, both chemically and mineralogically. It is economically practical to equip only mines of great extent with necessary concentrating machinery regulating the elimination of free quartz and other foreign substances.

It is an accepted fact that ores originating in the same deposit have the same mineralogical composition which is desired by all consumers of this commodity. It is also an accepted fact that spars of like chemical composition, as shown by a chemical analysis, may be totally unlike mineralogically. This is the case, usually, when spars from several deposits are mixed to prepare one of certain chemical composition.

For the purpose of meeting these conditions the Consolidated Feldspar Corporation and its associate companies are constantly improving a series of processes which is rightfully designated as "uniformity control." These processes actually produce feldspars of uniform mineralogical composition. The success of this practice is contingent upon the feldspar producer mining his product from deposits of proven extent and supplying the same ore from the same mine in each and every shipment, and preparing it by the necessary methods of uniformity control.

The outputs of such deposits are brought to the mill and are kept separate through all stages of their processing. After being crushed to approximately minus ½ inch in size, the material passes through driers to one of a number of storage bins, each of approximately one hundred tons capacity, devoted exclusively to spar from a particular mine. On entering the bin a continuous sample is taken representing an accurate cross section of the contents; this is later ground, analyzed and the analysis posted on the filled bin.

Let us assume then that a customer has standardized on spar from Mine A, having a chemical analysis of 68.50% silica, 18.00% alumina and other constituents in specified percentages. With four or five bins available containing Mine A spar, each with its known chemical analysis, manipulation of the proportion of discharge from any or each of these bins in units of accurate hundred pound quantities can be so made as to produce a spar that is uniform mineralogically and chemically.

This is in no sense a process of blending, but a controlling of individual spars. Bins containing the output of Mines B, C and others do not enter into the procedure, but are available for the same treatment on their own account in meeting the specifications of other consumers.

It is essential, if a constant material is to be produced, that an intelligent coordination of *all* the means contributing to uniformity be exercised. Each has its place—dependable deposit, selection, mechanical handling at each step, chemistry, grinding, loading—but the ultimate is not achieved until all are combined to the best advantage.

This accuracy of uniformity control permits of grouping feldspars under various classifications, on bases indicated by the particular requirements of the industry to be served. Feldspar for use in glass is classified on a different basis than that used for enamel purposes. These classifications are not to be confused with specifications; the manufacturer in submitting his specifications for fulfillment would automatically indicate under which classification his particular requirements occur. Such arrangement facilitates producer and consumer in cooperating on a known series of data.

Since chemical control has recently been so strongly advocated and has, in fact, many desirable features, a word along that line may be in order. This process of control, if properly handled, gives an accurate index of the chemical composition of the product under consideration, but nothing more; it tells nothing of the mineralogical composition or the physical functions of the material, nor does it guarantee that in its use by the maufacturer it will perform exactly the same as another quantity of like chemical composition but originating in different deposits. The full benefits of chemical control are to be realized only when it is employed in its proper importance as one unit of the control system in its entirety. Feldspar from any given section—and the section may be utterly different in space of a few hundred yards—has specific physical characteristics by no means necessarily duplicated in a spar of identical chemical composition from a different section. As a concrete example of this we may consider a South Dakota spar which can be duplicated chemically with Canadian or North Carolina spar, but the physical performance, the fused appearance and the reaction in the produce in which used will be totally dissimilar.

Melting point, fluxing behavior, firing range, contraction and expansion—these characteristics of feldspar are determined by the mineralogical constitution (the proportions in which the different types of feldspar occur) and by the eutectics of the feldspar. The mineralogical composition of feldspars determines the eutectic properties and in so doing controls the firing range. If there are variations in the mineralogical composition of feldspars, and these variations cannot be determined by chemical analysis, the eutectics and the firing range will not remain uniform, thus making it necessary for the ceramic manufacturer to alter his batch frequently or run the risk of spoiling his ware.

The ceramic manufacturer minimized the danger of feldspar troubles, and correctly so, by standardizing on feldspar from one district, selecting a location in which the feldspar usually met with his peculiar requirements. Thus arose the method of distinguishing feldspars according to districts—i. e., Maine feldspar, Canadian feldspar, North Carolina feldspar, South Dakota feldspar, etc.

But this method of specifying feldspar is merely an approximation of the scientific accuracy on which successful ceramic production should be based. For two feldspars mined from the same district often vary seriously in mineralogical constitution. And naturally the necessity for uniformly controlled feldspar has developed. The need for uniformly constant feldspar has grown more acute in recent years.

Uniformity control, therefore, as a complete process in all its various stages, is the only assurance which the manufacturer has at present of being supplied with a constantly mineralogically uniform product.

[1]Chief chemist, Consolidated Feldspar Corporation, Trenton, N. J.

Feldspar Conferences Continue

The general conference on feldspar held at the Bureau of Standards, Washington, at the request of the Feldspar Grinders' Institute, brought the attendance of a substantial number of representatives of prominent producers, and chemists, ceramic engineers, and feldspar production executives, sales managers, etc. The purpose of the meeting was the establishment of the industry's own classification for grades of feldspar by and with the cooperation of grinders, distributors, and consumers in order to arrive at a common basis of understanding in every day trade. The proposed standard developed by the Feldspar Grinders' Institute (see January issue, pp. 13-14) was used as a basis for discussion.

Detail requirements of the proposed standard were freely discussed. Regarding the physical classification it was suggested that additional fineness groups should be added, particularly that commonly referred to as 325 mesh. No decision was reached on this suggestion and the matter was referred to a special committee which was appointed to meet at the American Ceramic Society

Toronto convention. The columns in Table 1 of the proposed standards as published headed "Manufacturers Number" and "Manufacturers Standard" were thought to be superfluous and were deleted. The "Percent Tolerance in Average Opening" column was also dropped out. Opinions differed as to the chemical classification and as a result of suggestions made for additional groups with silica content below 68 per cent it was voted to provide such groups. One designated number 66 will include those up to and including 66 per cent while another designated number 67 will include those above 66 per cent up to and including 68 per cent. The question of potash-soda ratio was discussed and it was voted to make a group of six or more to 1 designated number 61. In view of the fact that the proposed standards for the third group of spars used in the manufacture of glass it was decided on motion of F. C. Flint, seconded by Joseph P. Rogers, that a sub-committee representative of the glass industry and the feldspar grinders be formed to draft a classification for feldspars suitable for the manufacture of glass.

After further discussion it was thought best to refer the whole matter of feldspar classifications to a committee of the industry. Upon motion of C. H. Peddrick, Jr., seconded by R. H. Wainford, it was voted that "a committee of the feldspar industry be appointed to revise the proposed commercial standard for feldspar using the revisions and suggestions made at today's meeting as a basis and that this committee be authorized to recommend a commercial standard for feldspar which will be presented directly to the industry for formal acceptance. The committee is to be composed of four members of the feldspar grinding industry, one representative of ceramic schools, one representative of the Bureau of Standards, and six representatives of feldspar consumers divided as follows: three manufacturers of whiteware, two of glass, and one of enamel."

Representing Feldspar Grinders:
B. C. Burgess (Chairman), Tennessee Mineral Products Co.
Chas. E. Golding, Standard Flint & Spar Corporation.
V. V. Kelsey, Consolidated Feldspar Corporation.
Joseph P. Rodgers, Seaboard Feldspar Co.

Ceramic Schools:
Arthur S. Watts, Prof. Ceramic Engineering, Ohio State University.

Bureau of Standards:
P. H. Bates, Clay and Silicate Products.

White Ware Manufacturers:
James Hamilton, Trenton Potteries Co.
Edw. Schramm, Onondaga Pottery Co.
L. E. Barringer, General Electric Co.

Glass Manufacturers, etc.
F. C. Flint, Hazel-Atlas Glass Co.
T. C. Earnill, Owens-Illinois Glass Co.
H. G. Wolfram, Porcelain Enamel & Mfg. Co.
Harry H. Steidle, Ex-officio Secretary, Division of Trade Standards, Bureau of Standards.

F. C. Flint was made chairman of the sub-committee which he was authorized to form to consider the feldspar classifications for the glass industry.

Feldspar Grinders' Institute Election

At the first annual meeting of the Feldspar Grinders' Institute held on February 21, 1930, at the New York Athletic Club, new officers were elected as follows:

President, H. P. Margerum, Consolidated Feldspar Corporation.
Vice-President, C. H. Peddrick, Jr., United Feldspar Corporation.
Vice-President, Herreld D. Thropp, Eureka Flint & Spar Company.
Vice-President, James Turner, Trenton Flint & Spar Company.
Secretary-Treasurer, L. L. Hunt, Bedford Mining Company.

The above with the following three men consist of the Directors of the Institute:

Richard Wainford, Trenton Flint & Spar Co.
Norman G. Smith, Maine Feldspar Co.
H. G. McLear, Green Hill Mining Company.

Pittsburgh Plate Annual Safety Conference

The fourth annual safety and insurance conference of the Pittsburgh Plate Glass Company was held February 11-13, 1930, at Barberton, Ohio. Safety in the factory, in the community, in the home, safety for one's own person, safety for each other and safety for property were all discussed at the meetings which began on Tuesday morning, February 11, and continued until Thursday, February 13. The opening feature was an address of welcome by H. A. Galt, vice-president of the Columbia Chemical Division. This was followed by an address by H. S. Wherrett, the President, and a review of 1929 by the Safety Director, C. E. Ralston. J. S. Dodge, insurance manager, spoke on the value to the company of fire-prevention efforts. During the day the following addresses were given: Organization and Training of a Private Fire Brigade, F. C. Stewart, Fire Chief, Works No. 4, Ford City, Pa.; Safety Glass Development and Value, N. J. Penning, General Manager of Operation, Duplate Corporation, Creighton, Pa.; Relation of Engineering and Construction Department to Plant Safety, R. D. Bole, Engineering Department; Handling Materials, T. R. Donoghue, Safety Engineer Works No. 1, Creighton, Pa.; Method of Organizing Fire Prevention Inspection and Caring for Equipment in the Small Plant, W. O. Carter, Works No. 12, Clarksburg, W. Va.; Value of First Aid Training to Plant and Community, F. V. Pettit, Safety Inspector, Columbia Cement Works, Zanesville, O.; Fire Prevention Value of Systematic Inspection and Reports, C. W. Kemp, Sr., Fire Chief, Works No. 9, Crystal City, Mo.; Safety Contests, C. O. Carson, Safety Inspector, Works No. 8, Kokomo, Ind.; Fire Hazards in the Home, H. J. Hartmann, Insurance Department; Home Safety, Lew R. Palmer, Conservation Engineer, The Equitable Life Assurance Society.

On Wednesday the subjects and the speakers discussing them were as follows: The Employe's Responsibility in Safety, G. E. Barker, Linseed Oil Division, Red Wing, Minn.; Safeguards and Their Relation to the Safety Program, J. H. Hatfield, Safety Inspector, Works No. 6, Charleroi, Pa.; Reaching the Individual with Safety, Fred Holloway, Superintendent, Ditzler Color Company, Detroit, Mich.; The Dollar Side of Safety, R. E. Vanatta, Employment Manager, Columbia Chemical Division, Barberton, O.; Educational Value of Safety Organization, J. T. Phelps, Safety Inspector, Newark, N. J.; Safety as a Community Asset, P. H. Wiegand, Milwaukee, Wis.; Importance of Good Physical and Mental Health in Industry, J. V. Willetts, Works No. 7, Elwood, Ind.; Cooperation Between Safety Inspector and Fire Department, J. J. Hobaugh, Safety Inspector, Works No. 4, Ford City, Pa.; Importance of Discipline with Relation to Safety, J. E. Jennings, Safety Inspector, Works No. 9, Crystal City, Mo.; Housekeeping and General Orderliness, W. A. Patterson, Safety Inspector, Rennous-Kleinie Division, Baltimore, Md.; Special Equipment for a Private Fire Brigade, M. B. Fassnacht, Fire Chief, Columbia Chemical Division, Barberton, Ohio; Hand Tools—Inspection and Care, J. A. Gorski, Safety Inspector, Works No. 11, Mt. Vernon, Ohio; Value of Safety Bulletin Boards and Plant Publications, J. M. Straley, Safety Inspector, Works No. 12, Clarksburg.

Thirty-seven men interested in safety attended the three-day conference, representing all of the Pittsburgh Plate Glass plants in the United States except those located in the Far West.

That safety problems are engaging the attention of glass manufacturers everywhere to a greater extent than ever before is indicated by the fact that an article, "How to Organize an Effective Safety System for a Glass Plant," by the company's Safety Director, C. E. Ralston, published in the January, 1930, issue of THE GLASS INDUSTRY, has attracted the attention of glass manufacturers even abroad and brought to the author requests for further information from such distant countries as England and Belgium.

Cleveland Company Changes Name

The shareholders of The Wellman-Seaver-Morgan Co., Cleveland, O., voted at the annual meeting February 18 to amend their articles of incorporation, changing the name of the company to The Wellman Engineering Company.

The new name is in keeping with the modern trend for brevity and is considered more descriptive of their type of business, which is the designing and building of gas producers and apparatus for handling and transporting raw materials from the mine to the finished products, including steel works equipment, car dumpers of all types, coke oven machinery, port and terminal equipment, hoisting machinery for mines, special cranes, coal and ore handling machinery, etc.

There was no change in the board of directors, the following having been re-elected: John A. Penton, G. W. Burrell, S. R. Willock, A. E. Gibson, Francis Seiberling, H. J. Crawford, Atlee Pomerene, John T. Webster, James Foster-Smith.

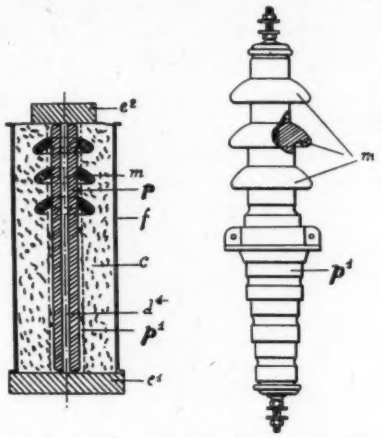
Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

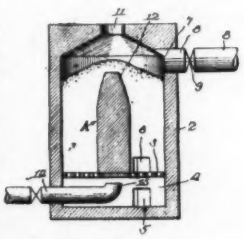
Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C., Price 10c each

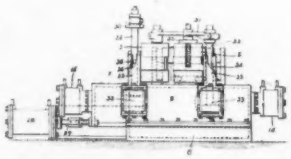
APPARATUS FOR SEVERING THE EDGES OF GLASS SHEETS. U. S. 1,744,046. Jan. 21, 1930. Howard L. Halbach and Don R. Limbers, Clarksburg, W. Va., assignors to Pittsburgh Plate Glass Company. Filed 9/21/28. Apparatus for separating the edge of an upwardly moving sheet of glass, comprising a heating element extending longitudinally of the sheet adjacent the edge thereof, a fixed supporting member, a second supporting member pivoted on said fixed member and carrying said heating element so that the element is free to adjust itself to the position of the sheet, and means for causing a flow of electric current through said element to heat it.

PROCESS FOR THE MANUFACTURE OF ARTICLES OF SILICA GLASS U. S. 1,724,844. Aug. 13, 1929. Pierre Henri Clement La Burthe, Nemours, France, assignor to Société "Quartz L Sillice," Paris, France. Filed 2/19/27. A process for the manufacture of fused silica glass articles of diverse shapes by adjunction of material to a previously formed tubular silica glass member, consisting of placing said member in contact with a mass of pulverulent silica, and of heating parts of said member, from within the same, together with the adjacent parts of the mass of pulverulent silica, in the zone of adjunction of material, to a temperature adapted to cause and complete fusion of the silica glass member and of the mass of pulverulent silica and to ensure an intimate welding of both parts, and in progressively displacing the previously formed tubular silica glass member and the heating means relatively to each other for the purpose described. The accompanying drawings represent the application of this process to the manufacture of bell insulators, this example serving to illustrate the most general case of the manufacture of articles by means of concentric elements made of silica.



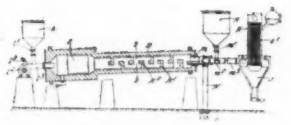
PROCESS FOR MANUFACTURE OF PRODUCER GAS. U. S. 1,743,726. Jan. 14, 1930. Willis J. Murdock of Joliet and Edgar E. Lungren, Aurora, Ill., and Owen B. Evans, Philadelphia, Pa., assignors to Pier Process Corporation of Aurora, Ill. Original application filed 9/23/24. Divided and this application filed 8/28/25. This invention consists in so disposing or disbursing the conglomerate mass of solid fuel as it is changed in the producer in its passage through the producer, that every portion of the fuel bed will be within an "active" area with respect to a radiating wall of the producer; in preventing the initiation of the formation of a compacted, relatively impermeable portion at any point in the fuel bed; in uniformly distributing the porosity of the fuel bed by coordinating the cross-sectional area of the fuel bed relative to its bounding surfaces as to prevent the formation of inactive cores; in so distributing the fuel while subjected to action in the producer, that the distance between any two walls transversely of the fuel bed does not exceed twice the width of the known or determinable active area of the fuel with respect to a radiating wall.



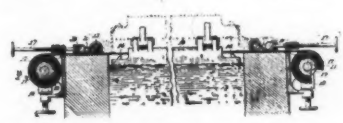


GLASS - FABRICATING MACHINE. U. S. 1,745,794. Feb. 4, 1930. Roswell F. Hatch, of West Hartford, Conn., assignor to Hartford Empire Company, Hartford, Conn. Filed 10/28/27. In the operation of the machine, the blow-molds are, by the movement of the box 5, alternately brought into the transfer position, and when the parison has been deposited in the blow-mold the blow-head associated with the blow-mold is positioned in capped relation with the mold and the blowing operation begun and proceeded with while the blow-mold is being moved away from the transfer position and another blow-mold moved into said position, and if desired until the take-out is about to occur.

GLASS-GOB CUTTER. U. S. 1,747,087. Feb. 11, 1930. Charles H. Schmalz, Kennett Square, Pa. Filed 12/1/26. A gob cutter for glass machines adapted to be positioned near the outflow of glass from a melting tank, said cutter including a hollow annular body formed with an annular discharge slit positioned to discharge toward a central point, said body being positioned so that the glass passing from said melting tank will flow axially through the center of said annular body, a pair of inlet pipes connected to said body on diametrically opposite sides and positioned to discharge gaseous matter into said hollow body at a tangent, said pipes being connected together, a supply pipe connected to said pipes at their point of juncture, and a three-way valve positioned at said point of juncture for causing gaseous matter to flow through either of said pipes independently, both pipes simultaneously and shut off the supply of gaseous matter according to the position of the valve key.



PROCESS OF MAKING PRODUCER GAS. U. S. 1,743,930. Jan. 14, 1930. Harald Nielsen, Muswell Hill, London, and Bryan Laing of Hatfield, England. Filed 8/9/24 and in Great Britain 8/17/23. A process of making producer gas, which consists in continuously introducing powdered solid carbonaceous material and admixed air longitudinally at one end of a gas producer with sufficient speed to keep the solid particles in suspension, combusting said powdered material and air, introducing a controlled volume of superheated steam into the combustion zone at a plurality of points along the length of the gas producer, continuously moving solid carbonaceous material longitudinally forward into the combustion zone from the opposite end of the gas producer, so as to gasify said last mentioned carbonaceous material, and removing the ash at that end of the gas producer where combustion takes place.

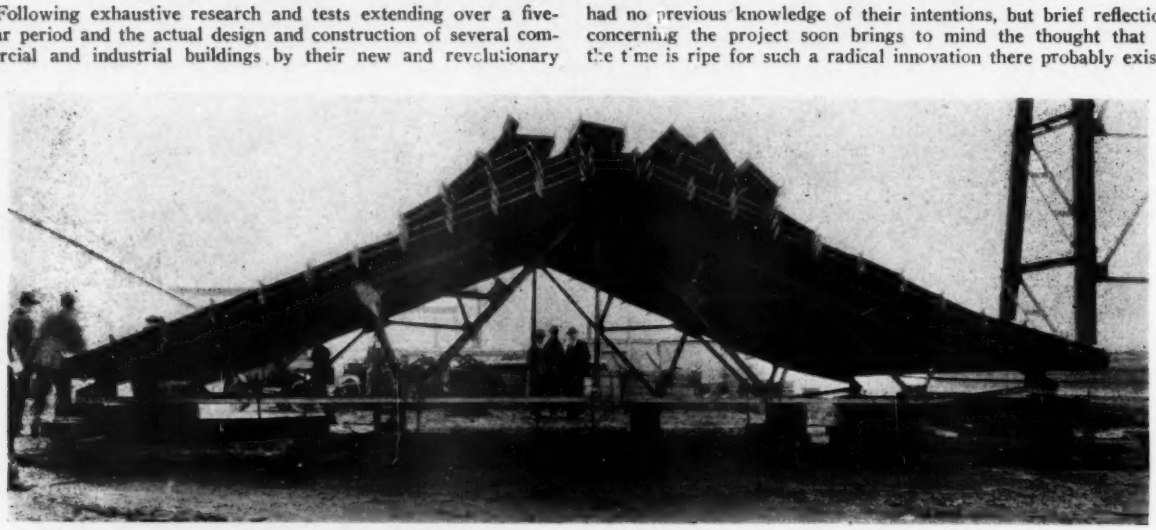


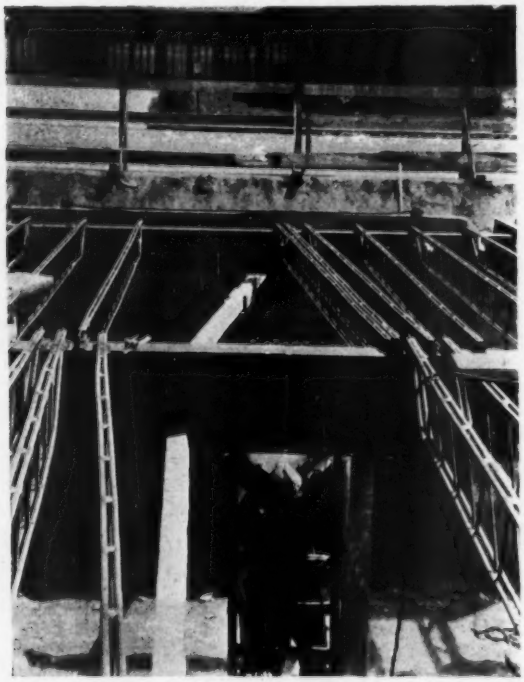
APPARATUS FOR MAKING PLATE GLASS. U. S. 1,746,695. Feb. 11, 1930. Charles D. Davis and Edwin L. Yewell, Washington, D. C. Filed 8/16/23. An apparatus for drawing plate glass in the flat embodying a container for the molten glass, a bait, a supply of metallic wire adjacent each end of the bait, the free end of the wire being adapted to be connected to the adjacent end of the bait, and means for continuously guiding and pressing the wire into the edge of the sheet while the same is in a soft condition, said means embodying a roller over which the wire runs, and means for positively and adjustably holding this roller in contact with the edge of the sheet. A scraper movable with the roller to clear the same of adhering glass.

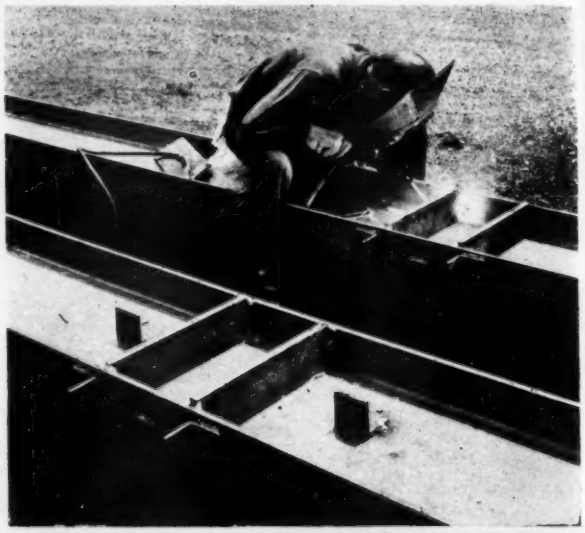
Nation-Wide Welded Steel Noiseless Building Service

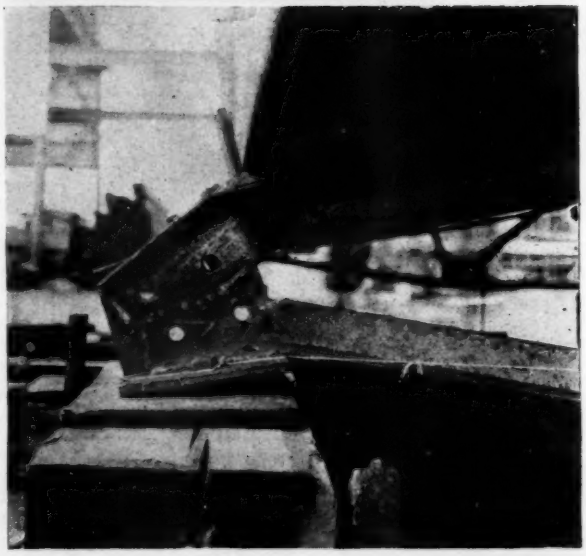
Following exhaustive research and tests extending over a five-year period and the actual design and construction of several commercial and industrial buildings by their new and revolutionary method, The Austin Company of Cleveland recently announced the organization of a service to undertake the design and erection of steel buildings by their noiseless welding method, instead of employing the usual riveted construction principle. As a practical and economical form of construction, they state, welding as now developed has numerous advantages over the present riveting method.

The announcement that this long firmly established and well known organization of builders would embark on such a revolutionary enterprise has been more or less startling to those who had no previous knowledge of their intentions, but brief reflection concerning the project soon brings to mind the thought that if the time is ripe for such a radical innovation there probably exists









ABOVE—TWO LARGE STEEL I-BEAMS JOINED BY WELDING. TOP VIEW—TEST OF RIVETED vs. WELDED TRUSS. SQUARE VIEW OF RIVETED TRUSS AFTER FAILURE.

TOP RIGHT—WELDING ANGLE BRACKETS AND OTHER PARTS TO A STEEL COLUMN.

BOTTOM RIGHT—TEST OF RIVETED vs. WELDED TRUSS. HEEL OF WELDED TRUSS WHERE FAILURE OCCURRED.

no engineering and construction organization in the country better qualified to introduce it.

The welding method is as well adapted to the construction of steel glass factory buildings as to warehouses or skyscrapers. The Austin Company is well known in the glass field, having designed and built a number of glass plants throughout the country with notable efficiency and speed, including several on the Pacific Coast. Its activities have also extended abroad and have included a contract for the design and construction in 15 months of a complete industrial city near Nizhni-Novogorod which is 270 miles east of Moscow. This is a forty million dollar project in which is included as a major unit, a complete automobile plant capable of turning out 100,000 Ford cars annually.

The accompanying photographs and their captions will give the reader a good idea of the possibilities inherent in the new Austin welding process as applied to the fabrication of steel structures. Welded steel construction, the company states, is offered at a cost comparable to that of other forms of construction. It provides great strength by fusing many steel members into one rigid structure, and possible savings in steel may be effected. Not the least attractive feature of the process is elimination of the noise caused by the compressed air hammers commonly employed for driving rivets.

Hygienic Effects of Ultraviolet Radiation in Daylight

In an article headed as above by Henry Phelps Gage, Chief, Optical Division of the Laboratory, Corning Glass Works, published in the October, 1929, issue of THE GLASS INDUSTRY, reference was made to experiments then being conducted at the poultry department of Cornell University by L. C. Norris and G. F. Heuser on daylight transmitting through various types of window glass as a means of preventing rickets in chickens. The results of the completed experiment were not available at the time the article was published but are now given below together with a reprint of the published account of the experiment up to the point to which the investigation had at that time been carried.

H. J. Sloan, working under the direction of L. C. Norris and G. F. Heuser, at the Poultry Department, Cornell University, Ithaca, N. Y., is attempting to ascertain the antirachitic value of noon, south exposure, daylight for raising chicks. The exposing pens on the south side of the brooder house are four feet square, and are heated by steam during cold weather. The window frames are tilted 47.5 deg. from the horizontal so the sun's rays are perpendicular at the time of the equinoxes. Each window is covered with approximately 13 square feet of transparent material. Common green window glass was used to glaze one window, and three ultraviolet transmitting materials were used to cover the other twelve windows. Material *A*, slightly diffusing, according to published data of Dr. W. W. Coblentz, transmits 89 per cent of the radiation of the .302 μ line of the mercury arc; material *B*, clear sheets, 55 per cent when new and 37 per cent after a few weeks' exposure to sunshine; and material *C*, considerably diffusing, transmits about 30 per cent. The chicks were so close to the window that diffusion should cause but little loss in effectiveness.

Chickens fed on a normal diet will develop rickets unless given some antirachitic factor such as cod liver oil or ultraviolet radiation. Some other animals such as white rats develop rickets only if fed a diet deficient in either calcium or phosphorus. The chicks in this experiment were fed a special uniform diet which had sufficient but not overabundant mineral content. The first experiment covered exposures of from one-half to four hours daily under each of the four kinds of windows. The season of year was from Dec. 22, 1927, to March 15, 1928, *i. e.*, the twelve weeks following the shortest days. The exposures were made each day regardless of weather and included sunshine and cloud for a period centering at noon. Except in the case of window glass there was apparently good protection against rickets with material *A*, one-half hour daily exposure; material *B*, 1 hour; material *C*, 2 hours. Common window glass with 4 hours' daily exposure did not, however, afford protection from rickets.

The second period of twelve weeks immediately following the spring equinox, March 22 to June 14, 1928, showed complete protection against rickets with material *A*, 10 minutes daily; *B*, 20 minutes daily; *C*, 40 minutes daily; and great protection, nearly but not quite complete, with half the above time; *i. e.*, *A*, 5 minutes; *B*, 10 minutes; *C*, 20 minutes. Window glass, 40 minutes daily, was almost as bad as those kept away from sunlight.

The third period, June 21 to Sept. 13, 1928, after reorganizing the plan and slightly improving the diet, gave complete protection with material *A* in 5 minutes, *B* in 10 minutes, *C* in 10 minutes, while those exposed under window glass 20 minutes daily were practically the same as those kept away from the light.

These first three experiments demonstrated how small was the amount of ultraviolet required for the health of the chicks, as well as the absolute necessity for the little which was required.

The fourth experiment, 6 weeks before to 6 weeks after the winter solstice, Nov. 11, 1928, to Feb. 1, 1929, was again revised as to diet, and the exposure periods shortened so as to show significant differences. Almost complete protection was afforded by material *A* in 40 minutes' exposure; material *C* and *C* showed partial protection only in this length of time. Window glass protection is nil.

The fifth experiment, 6 weeks before to 6 weeks after the spring equinox, Feb. 7 to May 2, shows complete protection with material *A* in 20 minutes, and partial protection in the same time with materials *B* and *C*. These results clearly demonstrate the advantage of using as highly transparent a window as possible if the time of exposure must be limited, yet if all-day exposure is feasible, the window material with but partial transmission may produce all the result that may be desired. Other unfavorable conditions, such as unsuitable direction of exposure of windows, might dictate the choice of a glazing material of highest transparency.

It is hoped that the full account of this work will be published shortly. Until then this brief outline of the results will have to suffice.—*From* THE GLASS INDUSTRY, *October*, 1929.

The conclusion of the experiment as now described by the author follows:

In the sixth experiment, six weeks before to six weeks after the summer solstice, May 10 to August 2, 1929, the exposure times were the same as the fifth, but the exposures were made every other day instead of daily. The exposure times are therefore divided by two in calculating the results. The protection secured in each pen is slightly greater than in the fifth experiment, *i. e.*, the exposure required is slightly less than one-half in the summer than is required in the spring.

A rough analysis of the results made by the present writer indicates ratios of the exposure times to secure the same result as approximately 1 for summer, 2½ for spring and 10 for winter, or the relative effectiveness of daylight as 100% for summer, 40% for spring and 10% for winter. These values are for the effectiveness of daylight, taking sunny and cloudy days as they came. The final results as published by Mr. Sloan will include a log of the clear and cloudy days, a series of actinometer readings by the urnanium, oxalic acid method with readings of the antirachetometer, a fluorescent photometer measuring the intensity of the ultra violet of shorter wave length than .31 μ.

In table III is given a preliminary estimate as to the time of daily exposure in minutes required to produce different degrees of cure of rickets in chickens at different seasons of the year.

Table III

Daily exposure in minutes.

GLASS A

	Winter	Spring	Summer
Complete cure	..	15	6
Nearly complete	40	10	4½
Partial cure	18	5	2
Some benefit	12½	2	1

GLASS B

	Winter	Spring	Summer
Complete cure	..	30	12
Nearly complete	..	23	8
Partial cure	40	10	4
Some benefit	25	6½	2½

GLASS C

	Winter	Spring	Summer
Complete cure	..	30	8
Nearly complete	..	23	7
Partial cure	50	12	3
Some benefit	30	6½	2¼

Cerium and Manganese Dioxides for Decolorizing

U. S. Patent No. 1,726,635. September 3, 1929. Wm. Chittenden Taylor, assignor to Corning Glass Works. Filed May 11, 1926, Serial No. 108,414, renewed August 4, 1928, on "Glass and Process of Decolorizing and Fining of Same," covers the use of cerium dioxide with manganese dioxide for decolorizing glass. Eight claims on the process of decolorizing and of intensifying the decolorizing effect of manganese dioxide, have been allowed. The inventor states:

In Patent No. 1,414,715 granted to me on the 2nd of May, 1922, I disclosed a process of increasing the ultra-violet absorption of a potash glass and of coloring the same by using cerium dioxide, preferably in the amount of three to six per cent, and manganese dioxide.

I have now discovered that cerium dioxide may be used with marked advantage in glass for purposes other than that of ultra-violet absorption. I have found that when cerium dioxide is added to glass in much smaller percentages than that specified in the above patent and in amounts not sufficient to cause appreciable coloration thereof, it tends to decrease the amount of manganese dioxide otherwise necessary for decolorizing purposes, thus effecting an appreciable saving of the latter.

I have also found that cerium dioxide when present in such small amount fulfills some of the functions of arsenic in glass, in that it is an oxidizing agent and is also an efficient fining agent for the removal of small bubbles and I propose to take advantage of this property of cerium dioxide and thus dispense with the use of arsenic which is commonly used for this purpose.

Furthermore the decolorizing efficiency of commercial manganese dioxide varies considerably, due probably to the presence of more or less of the lower oxides of manganese which have no decolorizing action and I have found that cerium dioxide when used in the aforementioned small amounts so changes these lower oxides as to render the entire manganese content available for decolorizing action, thereby making the poorer grades of manganese dioxide as effective as the more expensive grades and effecting a further saving in cost.

Moreover cerium dioxide produces the above-mentioned effects even in the absence of other oxidizing agents, such as niter, and I have found that a lime glass batch containing manganese dioxide as decolorizer and also containing cerium dioxide in the aforementioned amount, but containing no niter, will produce a colorless glass. Such a batch if it did not contain any cerium dioxide would be colored a distinct green by the iron which is normally present as an impurity in the batch materials and is not decolorized except by higher oxides of manganese which themselves are reduced when niter is lacking. Therefore, by addition of cerium dioxide, I am enabled to decrease the amount of niter ordinarily used in making such glasses or dispense with it entirely, thereby effecting a further saving in cost.

As an illustration of some of the glasses which fall within the scope of this invention I give the following compositions of glasses calculated from batches which I have melted:

	A *Percent*	B *Percent*
SiO_2	74.42	61.8
Na_2O	18.13	13.2
Al_2O_3	.95	.9
CaO	6.25	....
PbO	....	23.8
MnO_2	.06	.08
CeO_2	.19	.12

Composition A is a soda lime glass and composition B is a lead glass. Glasses made according to these formulæ would normally contain appreciable iron derived as an impurity from the batch materials or picked up from the refractories, but the amount of manganese dioxide required for decolorization will be much less in these batches than would be the case were cerium dioxide not present. It is to be understood that the amount of manganese dioxide required to produce decolorization in glasses can only be stated approximately for it is well known to those skilled in the art that this amount depends upon the amount of iron present, as well as upon the conditions of melting, such as temperature and length of time of melting. When too much manganese dioxide is used the glass is colored pink. If a glass batch contains manganese dioxide just sufficient to decolorize it and produce a colorless glass when melted, and if a small amount of cerium dioxide, say, two-tenths of one per cent, which is insufficient in itself to cause coloration, be added to the batch and the whole be melted, the resulting glass will be colored pink, indicating an excess of manganese dioxide. Therefore, in the presence of cerium dioxide the amount of manganese dioxide required for decolorization may be materially decreased.

Generally speaking, the relative effect of cerium dioxide in intensifying the decolorizing effect of manganese dioxide in both lead and lime glasses has been found to be about 3; that is to say, by using .15 per cent of cerium dioxide and a given quantity of manganese dioxide a decolorization was produced equal to that produced by three times the given quantity of manganese dioxide it used without cerium dioxide.

Replaces Arsenic

It should be pointed out that arsenic also has an intensifying effect on the decolorizing action of manganese dioxide though in much less degree than has cerium dioxide, but contrary to expectations arsenic does not add to or enhance the intensifying effect of the latter. On the contrary, arsenic nullifies the effect of cerium dioxide and should not be used in conjunction therewith. Since cerium dioxide can be used advantageously to replace arsenic as pointed out above, arsenic should be omitted when cerium dioxide is used in conjunction with manganese dioxide as a decolorizer.

In the foregoing description I have mentioned only cerium oxide, but certain other rare earth oxides, such as those of didymium and lanthanum, are also capable of intensifying the decolorizing action of manganese dioxide, though in less degree than cerium. Since the rare earth elements are separated only with great difficulty and are therefore quite expensive in the pure state, I prefer to to use the impure mixture commonly known as "rare earth hydrates" which contains didymium, lanthanum and about 40 per cent of cerium dioxide. Moreover, I do not wish to confine myself to the use of cerium dioxide or the rare earth hydrates, since any ceric salt or compound containing cerium in the higher valence will produce the same effect and falls within the scope of my invention.

The American Management Association will hold the first industrial Marketing Conference at the Blackstone Hotel, Chicago, Ill., March 5-6. The newly established industrial marketing division of the association, headed by C. R. Cary, vice-president of Leeds & Northrup Company, Philadelphia, will be in charge. The conference will be held adjacent to the National Management Congress at the Stevens Hotel, which runs from March 3 to 5. Problems of industrial marketing will be discussed by prominent business men and others.

The Harbison-Walker Refractories Co. in their annual statement for the year ending December 31, 1929, showed a net profit for the year of $5,256,413, an increase of 19.1% over the previous year. In his report Chairman H. W. Croft stated that the outlook for the coming year is quite encouraging, as, contrary to the fears of impending depression frequently heard in recent months, the volume of business has been well maintained and following the usual pre-inventory dullness of December the new year volume has opened up very satisfactorily. In addition to the regular dividend of 2% per annum on the common stock an extra dividend of 25 cents per share was paid on December 2, 1929. The annual stockholders' meeting will be held on April 21, 1930.

Joseph W. Robinson, formerly executive vice-president of the Libbey Glass Manufacturing Company, Toledo, O., was elected on February 4 at the annual meeting of the stockholders to be president of the company. He is also chairman of the executive and operating committees. During the past year the company increased its sales by 25% and more than doubled its earnings. At the same meeting W. F. Donovan, formerly vice-president was named chairman of the board of directors; John H. Wright was made vice-president and general manager; S. O. Richardson, Jr., vice-president; H. A. Crow, vice president in charge of sales; H. J. Hamlin, treasurer; R. D. Logan, secretary. The board of directors is comprised of the above officials and E. J. Marshall, H. E. Collin, J. D. Robinson, E. J. Barry, A. C. Parker and W. F. Donovan, Jr. The company produces large quantities of pressed and blown glassware of various types and is a large manufacturer of glass shields for X-ray equipment.

The Glass World and What It Is Doing

News of the Industry

Glass Research at Purdue University

Among the visitors to the Glass Division meetings was Dr. Karl Lark-Horovitz, Professor of Physics and Director of the Physical Laboratories, Purdue University, Lafayette, Indiana. Dr. Horovitz with three assistants is at present investigating the conductivity of glass at high temperatures, adsorption of ions on the glass surface, especially in glasses of the pyrex group, also electromotive forms of glass, especially colored glasses, both those containing ordinary metals like copper, iron, zinc and also glasses containing rare earths such as neodymium, praseodymium, and lanthanum. Plans are also being made to investigate viscosity of glasses at high

DR. KARL LARK-HOROVITZ

temperatures and to make mechanical tests on glass, including its shatterability. Work is also being done in the making of X-ray photographs of refractories. It is hoped that the results accomplished at the University will lead to the establishment of fellowships devoted to research in glass and refractories.

Dr. Lark-Horovitz was in charge of the advance research work in the Physics Department of the University of Vienna until 1925, and worked there from 1921 to 1925, on the electrochemistry of glass. Six students took their Doctor's degrees with him there in this type of work.

In 1925 he came, first to Toronto University, where he spent a year and a half in the investigation of crystal structures at low temperatures, and continued then with this work at Chicago University.

He has spent one-half year at Rockefeller Institute in the investigation of the properties of surface layers, and before going to Purdue University worked one year at Stanford University in the continuation of his X-ray work.

His activities at Purdue University are mostly concerned with work in X-rays, and problems of quantum physics, besides the work on glass referred to above.

Blower Manufacturers Merge

The P. H. & F. M. Roots Company, original patentees and for seventy years manufacturers of rotary positive blowers, pumps and meters has merged with other interests and is now under the control of the Stacey Engineering Company of Columbus, Ohio.

The new organization includes besides the Roots Company, The Connersville Blower Company, both of Connersville, Ind., The Wilbraham-Green Blower Company of Pottstown, Pa., and the Stacey Brothers Gas Construction Company of Cincinnati, Ohio. All companies involved in the merger will maintain their separate identities and organizations, and will continue to operate separately until the final plans of the merger can be consummated.

Great Chicago Marketing Center to Open

Next May there will be opened the Chicago Merchandise Mart. This, it is claimed, will be the largest building in the world. It is ten stories high and it is to be devoted to displays of merchandise such as glassware, lamps, china, etc. The building has a total floor area of 4,000,000 square feet, almost 100 acres. Corridors 650 feet long will be bordered with hundreds of lines of merchandise exhibits by manufacturers, wholesalers and importers. Bringing the buyer to a great central market instead of taking the merchandise to the merchant is the principle for which the mart stands. Among those in the glass field reported to have leased space are Diamond Glassware Company, Indiana, Pa., Wheeling, W. Va.; Carr-Lowrey Glass Company, Baltimore, Md.; Cambridge Glass Company, Cambridge, O.; Mirror & Art Glass Company, Chicago, Ill.; Fostoria Glass Company, Moundsville, W. Va.; Maryland Glass Company, Cumberland, Md.; Jeannette Glass Company, Jeannette, Pa.; Kopp Glass Company, Inc., Swissvale, Pa.; Peacock Art Glass Company, Akron, O.; Erskine Glass & Manufacturing Company, Wellsburg, W. Va.; Jefferson Glass Company, Follansbee, W. Va.; Federal Glass Company, Columbus, O.; McKee Glass Company, Jeannette, Pa.; Indiana Glass Company, Dunkirk, Ind.; D. C. Jenkins Glass Company, Kokomo, Ind.; Louie Glass Company, Weston, W. Va.

Reduction of Glass Tariffs Voted by Senate

Among the amendments to the Finance Committee's recommended tariff bill acted on by the Senate was one to provide an import rate of 40 per cent on machine made bottles and 75 per cent on hand blown bottles. The Finance Committee's original provision was for a rate of 82½ per cent on these products. The House provided a 70 per cent rate. On February 11 the Senate continued its rate slashing drive on various rates recommended by the Finance Committee, resulting in cutting down to the 1922 law the tariff rates on window and plate glass, and eliminated the increases on these two products ordered by President Coolidge and President Hoover respectively. Senator Barclay of Kentucky obtained approval by a vote of 41 to 40 of the amendment to cut window glass rates. Twelve Republicans and 29 Domacrats combined to put over the Barclay cuts while 36 Republicans and 4 Democrats opposed them. The rates on window glass proclaimed by the President last year ranging from 1⅞ to 3¾ cents a pound were lowered to a range of from 1¼ to 2½ cents. On plate glass, the increase proclaimed by President Coolidge was cut from 16 to 22 cents square foot to 12½ to 17½ cents. The plate glass reduction amendment was introduced by Senator McMaster, South Dakota, and carried by a vote of 43 to 36.

Libbey-Owens to Build New Addition

Libbey-Owens Glass Company, Toledo, O., will, it was recently announced, build an addition to their present factory that will represent an investment of several hundred thousands of dollars. This was approved by the directors of the company at the annual organization meeting in New York. Plans for the new plant addition have been prepared and bids received and the work it is thought will proceed immediately. The laminated glass plant has been running to capacity and is the cause of the new addition being built to supply a much felt need.

Plans for temporarily solving the financial problems of the Standard Plate Glass Company were reported in Pittsburgh newspapers on February 26. Holders of notes maturing March 1 deposited them with their protective committee.

Libbey-Owens Elects Officers

At the annual organization meeting of the directors of the company in New York elections were held with the following results: James C. Blair, who has been president of the company since the late Edward Drummond Libbey gave up active direction of the company, was re-elected to the presidency with Bert C. Root as vice-president and general manager. H. H. Baker, vice-president and secretary, C. H. Schmettau and H. E. Allen, vice presidents, and R. H. Taylor, treasurer.

January Production Polished Plate Glass Increased

The production of polished plate glass for the month of January, 1930, was 10,017,909 sq. ft., as compared with 8,482,289 sq. ft. produced in the preceding month December, 1929, and 11,425,575 sq. ft. produced in the corresponding month last year, January, 1929.

Trade Activities

The Anaconda Copper Mining Company is reported to be successfully recovering manganese from low grade deposits by flotation. The first public announcement of the discovery was made by the United States Bureau of Mines Experimental Station at Rolla, Mo. Since December 16, 1929, the company has treated approximately 12,000 tons of manganese (Rhodochrosite) ore, averaging between 29.5 per cent and 30 per cent (Mn) metallic manganese and over 20 per cent (SiO_2) silica. The concentrates have averaged between 38 and 40 per cent metallic manganese and under 6 per cent silica. The recovery of manganese in the flotation plant has averaged about 95 per cent. Material is being treated at the rate of 300 tons a day and the finished product shipped at the rate of 200 tons per day to the Domestic Manganese & Development Company at Butte, Montana, for nodulizing. The nodulized product runs approximately 60.8 per cent metallic manganese and 6.9 per cent silica. This claimed to be the highest grade manganese ore ever introduced into the world's market.

The crude ores are being drawn from the Emma mine, owned by the Butte Copper & Zinc Company and operated by the Anaconda Copper Mining Company. This discovery greatly increases the reserves of available ores in the Butte district.

The rated capacity of the present plant of the Domestic Manganese & Development Company is 200 tons per day or 72,000 tons per year.

The American Bottle Company branch of the Owens-Illinois Glass Company at Newark, O., recently denied, through David Denelsbeck, a rumor which grew out of reports resulting from changes in personnel of the local factory and transfer of employes to the Fairmount, W. Va., plant, that the Newark plant was to be shut down. Mr. Denelsbeck said he had received no orders to decrease the normal activities of the plant. According to a report in the Newark, Ohio, *Advocate,* the situation in regard to this plant was explained by J. H. McNerney of the company's organization at Toledo who stated that for some years past the company has tried in every way possible to operate the Newark plant somewhere near capacity, but that owing to the shortage of orders for beer bottles had been unable to obtain sufficient business to operate on a satisfactory basis. Partial operation has been very unsatisfactory and cannot be continued indefinitely. The Newark plant is operating only five of its eleven furnaces and employs about two-thirds of its normal personnel.

The American Window Glass Company at a meeting of the board of directors on February 18 decided to pass the semi-annual dividend on the 7% preferred stock, payable March 1. The dividends on this stock are cumulative and have been paid without interruption since November 1, 1913. The decision to omit this dividend is reported to have been made in order to conserve the cash assets of the company during the present period of depression in the window glass business and on account of the company's manufacturing plants undergoing reconstruction due to the change from the cylinder blowing process to the Fourcault sheet blowing process. It is stated that the company has no indebtedness of any kind except bills for current accounts and federal taxes now undergoing adjustment.

The Corning Glass Works, Corning, N. Y., at the annual meeting of their directors elected Amory Houghton to be president of the company. Dr. Eugene C. Sullivan, who has been acting as executive vice-president, was named vice-chairman of the board. Alanson B. Houghton, A. D. Falck and George B. Hollister constitute the executive committee. The directors are Alanson B. Houghton, A. D. Falck, E. C. Sullivan, George B. Hollister, Amory Houghton, J. I. Thomas and A. A. Houghton, Jr. Mr. Falck is chairman of the board, Wm. H. Curtiss and Arthur L. Day are vice-presidents, John L. Thomas, secretary and treasurer, F. F. Pfeiffer, assistant secretary, Wm. R. Green, Jr., general counsel.

Standard Plate Glass Company. The holders of $3,000,000 of 6% notes of the Standard Plate Glass Company due March 1 have received a proposal from the noteholders' protective committee proposing that they accept payment for 75% of their holdings in cash and grant an extension of six months for the payment of the remaining 25%. Under this plan the company will also pay the interest due on March 1 and the extended portion of the notes will bear interest at the rate of 6%. In order to complete the plan at least 75% of the noteholders must agree to the proposed extension of the notes.

The Libbey-Owens Glass Company, Toledo, O., on February 4 declared the regular quarterly dividend of 25 cents per share upon each no-par share of stock, payable March 12. Furthermore a dividend on the basis of $1.00 per share on each $25 par value share was declared payable on the last day of March, 1930, providing the $25.00 par certificates have been exchanged by that date on the basis of four no-par shares for one $25.00 par share, or as soon thereafter as such exchanges have been made.

The Oil City Glass Bottle Company, Oil City, Pa., recently organized with R. R. Underwood of the Knox Glass Bottle Company as president has a new one story 50 by 200 foot factory at McClintockville under construction by the Clarion Block Company, Clarion, Pa., and it is expected that the building will be completed during March and the plant will be equipped and operating by May 1. It is said that approximately $100,000 has been invested in the enterprise.

The American Flint Glass Workers Union has requested Secretary of Labor Davis to make a survey of the industry with the object of ascertaining facts that will assist in stabilizing employment. Charles H. Shipman and Harry H. Cook, secretary and assistant secretary, have the matter in charge. Mr. Davis is taking the matter under consideration. Only sixteen lamp chimney factories are at present in existence according to the statement made by the Union officers.

The Economy of Soft Water. A new 16-page bulletin on the Elgin Zeolite Water Softening System has just been published by the Elgin Softener Corporation, Elgin, Ill. This 16-page book, printed in black and blue discusses the advantages of soft water in the various industries, the problems of scale, rust, corrosion, incrustations and the influence of hard water upon fuel bills, textiles, linens, etc.

Wilbur F. Brown, of the Libbey-Owens Glass Company, Toledo, O., recently became a victim of appendicitis. After arguing with his doctor for an hour and considering the situation for another hour a very successful operation was performed. Fortunately and characteristically he made a quick recovery and was soon "back on the job."

Thatcher Manufacturing Company, Elmira, N. Y., is among the glass factories whose net profits during 1929 were largest in their histories, theirs amounting to about $900,000 or approximately $3.00 a share on the outstanding common stock. More than half of the total earnings were made during the latter half of the year.

The Swedish Glass Manufacturers Export Association (Svenska Glasbrukens Exportforening) which includes fifteen manufacturers of glassware in Sweden has been formed for the purpose of promoting sales of their products in foreign countries. Special attention will first be given to the English market.

The Bonita Glass Corporation, Huntington, W. Va., has been incorporated under the laws of West Virginia with an authorized capital of $25,000. The incorporators include the following: W. C. Lerch, John E. Jenkins, E. G. Huston, Willa Steele, and Lola Chapman, all of Huntington.

The Austin Company, Cleveland, O., recently announced the appointment of Ralph Leavenworth as assistant sales manager. Mr. Leavenworth has for a number of years been associated with The Paul Teas, Inc., advertising agency in Cleveland and has been in close touch with the Austin Company's engineering and building activities in the glass and other fields.

The Imperial Glass Company, Bellaire, O., has elected George W. Hannan of Wheeling, W. Va., president of the company in succession to the late Victor G. Wicke. J. Ralph Boyd is now general manager of the company, J. M. DuBois of Bellaire, vice-president; Otto Schenk, of Wheeling, second vice-president; J. F. Mallott, Bellaire, treasurer.

The Hazel-Atlas Glass Company, according to a report from Clarksburg, W. Va., will operate its Sycamore Street plant during the remainder of 1930 at about 75 per cent of its capacity. This statement, attributed to J. H. McNash, president of the company at Wheeling, W. Va., shows about the same rate of production as that prevailing last year.

Wightman Bottle & Glass Company, Parkers Landing, Pa., have resumed operations in their new plant which will have a capacity, it is said, of about 45 tons production per day. R. R. Underwood is president of the company, J. H. Fithian, vice-president and superintendent, E. C. Griffith, secretary and treasurer.

West Virginia Glass Specialty Company, Weston, W. Va., started their recently completed tank into operation at their Homeward factory on February 17. Additional tanks are being constructed. E. Hager is manager of the plant and Louis Wohinc, the well known glass man is interested.

The Scohy Sheet Glass Company, Sistersville, W. Va., reports through John R. Scohy that production of sheet glass on February 14 exceeded all records known both in the United States and Europe for 24 hours' production. The plant is equipped with Fourcault drawing machines.

The Pittsburgh Plate Glass Company, Pittsburgh, Pa., has taken over the business of the Standard Plate Glass Company at Youngstown, O. It is reported that the branches of the Standard Plate Glass Company at Boston, Buffalo, and Cincinnati are to be liquidated.

The Austin Company, engineers and builders, Cleveland, O., have been awarded a contract for the construction of a two-story, 60 by 120-foot furnace building for the Hocking Glass Company, Lancaster, O. The estimated cost is reported to be $35,000.

The Pittsburgh Plate Glass Company during the past month put into operation at Mount Vernon a drawing tank which is equipped with four modern machines. This gives the company a total of eight drawing machines at this plant.

The Harshaw Chemical Company, Cleveland, O., at their recent annual meeting elected Wm. B. Lawson, formerly connected with the International Nickel Company of Canada, Ltd., to be a director and vice-president of the company.

Niagara Frontier Glass Company has been incorporated in New York State to deal in plate glass. George A. Simmons, Jr. and Wesley H. Bal[illegible] of Buffalo and Emil F. Krupp of Kenmore, N. Y., are named as stockholders.

The Clearview Glass Company, Renfrew, Pa., Charles H. Christy, president, is operating a grinding and polishing plant for wire and plate glass, the blanks being purchased from manufacturers of those products.

The Mathieson Alkali Works reported for 1929 the largest annual earnings in the company's history, equivalent after deduction for preferred dividends to $3.31 a share on the common stock.

The New Martinsville Glass Company, New Martinsville, W. Va., is resuming operations. Orders sufficient to assure continuance of operation for several months are said to be on hand.

Charles H. Mathews, Jr., Pittsburgh, has been elected a director of the Macbeth-Evans Glass Company to succeed Sidney Mason of Philadelphia who resigned.

The United States Glass Company, Pittsburgh, recently put several additional furnaces into operation to take care of increased demands for its production.

The Capstan Glass Company is completing improvements and repairs in their plant at Connellsville, Pa. An increase in gas producer capacity is included.

The Pennsylvania Bottle Company resumed operations in their Sheffield, Pa. factory early in February after being shut down for extensive repairs.

The American Plate Glass Company has resumed full operations in their factory at Durant City, Pa., after a shut down of several weeks for repairs.

D. C. Jenkins Glass Company, Kokomo, Ind., closed their plant at Arcadia early in February for tank rebuilding and other repairs.

Feldspar Glass Ltd., Oshawa, Ontario, recently lost its test furnace building by fire.

What The World Wants

Specific Inquiries for American Goods Received in the Department of Commerce, Washington, D. C.

Scotland—43531. Glass and china ware.

Porto Rico—43731. Plate glass.

France—43643. Glassware, decorative art, pressed glass in colors or clear; and plain glass utensils.

South Africa—43958. Glass, cut, and colored glass plates, goblets, etc.

Recent Deaths

J. N. Davidson

Josiah N. Davidson, one time president of the Columbia Plate Glass Company and prominent for many years in banking affairs in Pittsburgh, died at his home in that city on February 17.

John Jacob Beck

John Jacob Beck, President of the Glenshaw Glass Company, Inc., Glenshaw, Pa., died on Tuesday, Feb. 4, 1930. His death comes as a distinct loss both to the trade and all who knew him.

Inquiries Received

For further information address THE GLASS INDUSTRY

484. Where can we obtain glass bricks for building purposes?

485. Kindly tell us where we can get a book teaching the art of glasscutting, (cutting designs on glassware). Also kindly give us the names and addresses of manufacturers of non-cut glassware and also those of the manufacturers of the equipment to cut it.

486. Please put me in touch with a concern which can produce spun glass to be made up into thin sheets or mats, between $\frac{1}{16}$" and $\frac{3}{32}$" thick, measuring possibly 7" x 10" rectangular, and being quite similar perhaps to the asbestos mats sometimes placed on stoves to prevent some foods "burning on" when cooking.

487. Where can we obtain cylindrical glass about 24" long and 12" inside diameter that would stand temperature changes ranging from 30° above to 75°? What we have in mind is a pump similar to gasoline pumps that show the liquid as it is forced into the pump. Both the top and bottom of the glass would have to be ground so that they would fit tight and not leak.

READERS' WANTS AND OFFERS

ASSISTANT SALES MANAGER

WANTED—With experience in window glass work. Address SALES MANAGER, c/o The Glass Industry, 50 Church St., New York.

MERCHANDISE WANTED

Slow moving stock, close outs, job lots, quantity lots preferred. Will purchase outright or sell for your account. What have you to offer? Goss Trading & Sales Company, 60 Sunset Trail, Bronx, New York.

Current Prices of Glass-Making Materials

February 19, 1930

Quotations furnished by various producers, manufacturers and dealers.

Acid		Carlots	Less Carlots
Citric (dom.)	lb.	.46	.46
Hydrochloric (HCl) 20° tanks, per 100 lb		..	1.10
Hydrofluoric (HF) 60% (lead carboy)	lb.	..	.13½
52% and 48%	lb.	.10	.10-.11½
Nitric (HNO_3) 38° carboy ext. Per 100 lb.		5.50	..
Sulphuric (H_2SO_4) 66° tank cars	ton	15.50	..
Tartaric	lb.		.38
Alcohol, denatured	gal.	..	.52
Aluminum hydrate ($Al(OH)_3$)	lb.	.04½-.05	.05½-.06
Aluminum oxide (Al_2O_3)	lb	..	.07
Ammonium bifluoride (NH_4) FHF	lb.	..	.21-.22
Ammonia water (NH_4OH) 26° drums	lb.	.03	.03¼
Antimony, metallic (Sb)	lb.	..	.09¾
Antimony oxide (Sb_2O_3)	lb.	..	.105-.11
Antimony sulphide (Sb_2S_3)	lb.	..	.14
Arsenic trioxide (As_2O_3) (dense white), 99%	lb.	.04	.05
Barium carbonate ($BaCO_3$), Crude, (Witherite) 90%, 99% through 200 mesh	ton	47.00	..
90% through 100 mesh	ton	44.00	..
Barium hydrate ($Ba(OH)_2$)	lb.	..	.05-.05½
Barium mixture, glassmaker's, f.o.b. St. Louis	ton	25.00	..
Barium nitrate ($Ba(NO_3)_2$)	lb.	.08¼	.08½
Barium selenite ($BaSeO_3$)	lb.	..	..
Barium sulphate, in bags	ton	..	..
Barium sulphate, glassmaker's, carlots, bulk, f.o.b. shipping point,	ton	15.00-16.00	18.00
Bone ash	carlots, lb.	.06	.06½
Borax ($Na_2B_4O_7 10H_2O$)	lb.	..	.0355-.0425
Crystal	lb.	.028-.033	..
Granulated	lb.	.025-.03	..
Powdered	lb.	.02875-.03375	..
Boric acid (H_3BO_3)	lb.	.0625-.07125	.06-.06125
Refined	lb.	.0625-.07125	.07125-.08125
Cadmium sulphide (CdS)—			
Red	lb.	..	1.20
Orange	lb.	..	1.00-1.10
Yellow	lb.	..	1.00-1.10
Chromium oxide (Cr_2O_3)	lb.	.24	.25
Cobalt oxide (Co_2O_3)			
In bbls.	lb.	..	2.00-2.10
In 10 lb. tins	lb.	..	2.15-2.25
Copper oxide			
Red (Cu_2O)	lb.	..	.30
Black (CuO)	lb.	..	.28-.30
Black prepared	lb.	.	.30
Cryolite ($Na_3Al\ F_6$) Natural Greenland Kryolith)	lb.	.09	.10-.10½
Artificial or Chemical	lb.	..	.09½
Epsom salts ($MgSO_4$) (imported) Per 100 lb.		..	1.15-1.20
Feldspar—			
100 mesh	ton	12.50-20.00	13.50-22.00
80 mesh	ton	11.00-11.75	14.50
40 mesh	ton	11.00	13.50
Fluorspar (CaF_2) domestic, ground, 95-98% (max SiO_2 2½%)			
Bulk, carloads, f.o.b. mines	ton	32.50	..
In bags or barrels	ton	36.50	41.50
Formaldehyde	lb.	..	.08¾-.09¾
Graphite (C)	lb.	..	.04-.07
Iron oxide—			
Red (Fe_2O_3)	lb.	..	.0450
Black (FeO)	lb.	.04½	..
Kaolin (f.o.b. mine)	ton	9.00	..
English, lump, f.o.b. New York	ton	14.50-25.00	24.50-30.00

Kryolith (see Cryolite)			
Lead chromate ($PbCrO_4$)	lb.	..	..
Lead oxide (Pb_3O_4) (red lead)	lb.	.0875	.0975
Litharge (PbO)	lb.	.0775	.0875
Lime—			
Hydrated (Ca(OH)₂) (in paper sacks)	ton	10.50	..
Burnt (CaO) ground, in bulk	ton	7.00	..
Burnt, ground, in paper sacks	ton	9.00	..
Burnt, ground, in 280 lb. bbls.	Per bbl.	2.15-2.25	2.30-2.60
Limestone ($CaCO_3$)		2.00-2.50	..
Magnesia (MgO)—			
Calcined, heavy (in bbls.)	lb.	.06	.07
light (in bbls.)	lb.	..	.23
extra light (in bbls.)	lb.	..	.37
Magnesium carbonate ($MgCO_3$)	lb.	.06	.07
Manganese 85% (MnO_2)	lb.	.04	.04½
Nickel oxide (Ni_2O_3), black— for nickel content	lb.	..	.35
Nickel monoxide (NiO), green— for nickel content	lb.	..	.35
Plaster of Paris, bags	ton	21.00	23.00-29.00
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb.	.09	.09¾
Ground	lb.	.11	.12
Potassium carbonate—			
Calcined (K_2CO_3) 96-98%	lb.	.06½	.07
Hydrated 80-85%	lb.	.05¾	.06
Potassium chromate (K_2CrO_4)	lb.	..	.23-.32
Potassium hydrate (KOH) (caustic potash)	lb.	.07½	.08
Potassium nitrate (KNO_3) (gran.)	lb.	..	.05⅞-.06
Potassium permanganate ($KMnO_4$)	lb.	.16	.16¼
Powdered blue	lb.	..	24-.26
Rochelle salts, bbls.	lb.	..	.22
Rouge	lb.	..	..
Rutile (TiO_2) powdered, 95%	lb.	.15-.20	.20-.25
Salt cake, glassmakers (Na_2SO_4)	ton	22.00	..
Selenium (Se)	lb.	..	1.80-1.90
Silver nitrate ($AgNO_3$)	(100 oz.) per oz.	..	.31¼
Soda ash (Na_2CO_3) dense, 58%—			
Bulk, on contract	Flat per 100 lb.	1.22½	..
In barrels	Per 100 lb.	1.55-1.57½	1.90
In bags	Per 100 lb.	1.37½-1.40	1.72½
Spot orders.. .025 per 100 lbs. higher			
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.07	.07½
Sodium hydrate (NaOH) (caustic soda) Solid	Per 100 lb.	2.95	..
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	lb.	.03⅞	.04½
95 per cent	Per 100 lb.	2.16	2.30
Sodium selenite (Na_2SeO_3)	lb.	..	2.35
Sodium fluosilicate (Na_2SiF_6)	lb.	.05	.05½
Sodium uranate (Na_2UO_4) Yellow or Orange	lb.	..	1.50
Sulphur (S)—			
Flowers, in bbls.	Per 100 lb.	3.45	3.80-4.00
Flowers, in bags	Per 100 lb.	3.10	3.45-3.65
Flour, heavy in bbls.	Per 100 lb.	2.85	3.20-3.40
Tin chloride ($SnCl_2$) (crystals)	lb.	.39	.37½
Tin oxide (SnO_2) in bbls.	lb.	..	.42
Uranium oxide (UO_2) (black, 96% U_3O_8) 100 lb. lots. Black	lb.	..	2.75
Yellow	lb.	..	1.50
Zinc oxide (ZnO)	lb.	.03½	.12
American process, Bags	lb.	.06½	.07
Zircon			
Granular (Milled .005-.02c higher)		.07	.07½-.08
Crude. Gran. (Milled .005-.02c higher)		.03½	.04-.05

Monthly Summary of United States Foreign Commerce in Glass

EXPORTS

Corrected to January 23, 1930

	December 1928 Quantity	December 1928 Value	December 1929 Quantity	December 1929 Value	Twelve Months Ending December 1928 Quantity	Twelve Months Ending December 1928 Value	Twelve Months Ending December 1929 Quantity	Twelve Months Ending December 1929 Value
Glass and glass products (Total)	.....	$880,612	.....	$842,557	.....	$10,108,140	.....	$10,931,119
Plate and window glass—								
Window glass, common, box 50 sq. ft.	3,575	$13,484	367	$2,541	18,601	$102,390	15,533	$91,909
Plate glass, unsilvered, sq. ft.	214,635	61,081	185,798	70,776	2,279,978	680,726	2,042,650	745,379
Other window and plate glass lbs.	377,988	43,928	402,394	35,139	3,904,830	439,429	4,778,188	512,818
Glass containers (bottles, vials and jars)	.....	261,720	.....	251,570	.....	3,514,936	.....	3,570,167
Table glassware, plain	.....	120,801	.....	137,171	.....	1,381,617	.....	1,523,447
Table and other glassware, cut or engraved	.....	7,342	.....	16,881	.....	135,411	.....	135,365
Lamp chimneys and lantern globes lbs.	123,630	25,349	76,605	16,836	1,600,626	326,746	1,581,218	319,502
Globes and shades for lighting fixtures lbs	175,283	60,649	169,930	62,429	1,813,637	644,954	2,080,253	749,820
Chemical glassware lbs.	22,569	20,564	25,259	25,195	230,647	200,820	290,072	249,076
Electrical glassware, except for lighting lbs.	380,405	45,728	146,023	14,427	4,727,289	423,883	4,872,988	406,042
Other glassware	.....	219,966	.....	209,592	.....	2,257,228	.....	2,627,594

IMPORTS

Corrected to January 23, 1930

Glass and glass products	.....	$1,131,741	.....	$879,242	.....	$15,239,755	.....	$13,992,792
Cylinder, crown and sheet—								
Unpolished, not bent, obscured, beveled, etc.—								
Weighing less than 80 pounds per case dut. lb.	3,588,524	$112,683	1,037,678	$54,921	37,178,043	$1,113,079	33,988,569	$961,562
Weighing 80 pounds or over per case dut. lb.	2,450,894	101,704	1,073,241	42,228	30,413,337	1,341,857	32,830,699	1,223,033
Polished and bent, obscured, beveled, colored, etc., unpolished and polished, and all silvered dut.	.....	41,770	.....	43,122	.....	560,724	.....	564,007
Plate glass—								
Polished, unsilvered dut. sq. ft.	1,106,605	209,983	815,793	157,536	15,842,620	3,355,276	10,952,783	2,256,897
Other dut. sq. ft.	125,184	24,879	335,476	50,311	1,727,173	428,443	1,827,385	362,623
Bottles, vials, jars, demijohns and carboys, molded or pressed dut.	.....	22,502	.....	69,460	.....	247,663	.....	308,382
Table and kitchen utensils dut.	.....	34,069	.....	17,985	.....	298,098	.....	281,823
Glassware, cut or decorated dut.	.....	244,829	.....	196,142	.....	2,904,932	.....	3,264,993
Blown glassware, n. e. s.—								
Bottles, ornaments, gauge glasses and other n. e. s. dut.	.....	75,893	.....	40,889	.....	1,885,090	.....	1,701,813
Bulbs for electric lamps dut. No. 1	1,785,874	20,548	1,027,628	9,164	15,741,013	175,334	15,227,204	137,299
Chimneys, globes, shades, prisms and other illuminating glassware dut.	.....	97,365	.....	52,702	.....	987,899	.....	801,852
Articles and utensils for chemical, scientific, and experimental purposes dut.	.....	49,331	.....	42,792	.....	548,349	.....	647,679
Other glassware dut.	.....	96,185	.....	101,990	.....	1,393,011	.....	1,480,829